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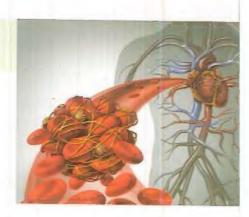
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CHAPTER

Nutrition and Digestion in Living Organisms

Lesson 1 : Autotrophic Nutrition (Absorption of Water and Salts).

Lesson 2: Continue: Autotrophic Nutrition (Photosynthesis in Green Plants).

Lesson 3: Heterotrophic Nutrition.

Model Exam on chapter 1

Objectives of the chapter

By the end of this chapter, the student should be able to:

- · Identify the concept of nutrition in living organisms.
- · Differentiate between the heterotrophic and autotrophic nutritions.
- · Mention the adaptation of root hair to perform its function.
- · Explain the steps of photosynthesis.
- · Identify the concept of nutrition in man.
- · Illustrate the processes of digestion inside the organs of digestive system.
- Explain the process of absorption in small intestine.
- · Explain the role of enzymes in the different digestion processes.
- Deduce the importance of food for human.



ONE

Autotrophic Nutrition

(Absorption of Water and Salts)

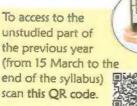
Nutrition

 Nutrition is one of the most important life characteristics that are varied in the living organisms.

Nutrition

The scientific study of food and various modes by which the living organisms feed.

To access to the unstudied part of the previous year (from 15 March to the end of the syllabus)



The importance of food for the living organism

- 1 It is the source of energy required to accomplish all the vital processes in the body of living organism.
- It constitutes the raw material needed for the growth and repair of the worn-out tissues.

Types of nutrition

• There are two types of nutrition, which are:

Types of nutrition



Autotrophic nutrition

Heterotrophic nutrition

First

Autotrophic nutrition

• Autotrophs are those organisms which can manufacture their food by themselves through chemical reactions that occur inside their cells to synthesize the high-energy and complex organic food compounds which are needed for the body building, such as : carbohydrates (sugar and starch), fats and proteins from simple, raw and low-energy inorganic materials, such as : carbon dioxide, water and mineral salts from the surrounding environment, by utilizing the light energy of the Sun to accomplish these chemical reactions which are collectively called "photosynthesis".



that are inorganic, simple, raw and low-energy.

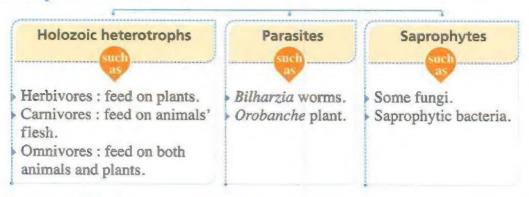
(Water, mineral salts and carbon dioxide).

Compounds
that are organic, complex and high-energy.

(Carbohydrates, fats and proteins).

Second Heterotrophic nutrition

- Heterotrophs are those organisms that obtain their food from the bodies of other living
 organisms (green plants or from the animals that have previously feed on plants) in
 the form of high-energy and complex ready organic food substances, such as: proteins,
 carbohydrates and lipids.
- Heterotrophs are classified into:



"All the living organisms obtain their food from the Sun in a direct way". How far this statement is correct? With explanation.

Autotrophic nutrition in green plants

• The autotrophic nutrition which is carried out by the green plants occurs through two important processes, which are:

Autotrophic nutrition in green plants

First

Absorption of water and salts process

Photosynthesis process

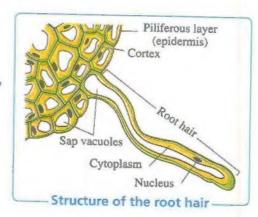
First Absorption of water and salts process

 The higher green plants absorb water and mineral salts from the soil through the root hairs that present in the root system of plant, then this soil solution is transported from one cell to another towards the transport vessels.

Root hair

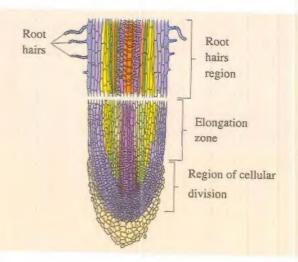
• Its structure:

- It is considered an extension of a single cell of the piliferous layer (epidermis).
- It is lined internally with a thin layer of cytoplasm, and contains a nucleus and a large sap vacuole.
- Its length: it is about 4 mm.
- Its age: it doesn't exceed a few days or weeks, because the epidermal cells are teared (lost) from time to time, but they are regenerated continuously from the elongation zone of root.



Do you know ... ?___

- On examining a longitudinal section in the root, we find that it consists of several important regions, which are:
 - Cellular division region.
 - Elongation zone that compensates the teared root hairs from time to time.
 - Root hairs region in which the root hairs appear as extensions of the piliferous layer cells.



Sutability of the root hair to its function :

- Being large in number and protruding to outside: to increase the surface area of water and salts absorption.
- Maving thin wall: to permit the passage of water and salts through it.
- Secreting a viscous substance :
 - To help these hairs to find their way easily among the soil particles.
 - To stick to the soil particles, and so they can fix the plant into the soil.
- The solution inside its sap vacuole is more concentrated than the soil solution:
 To help the water passage from the soil to the root hair (by osmosis).

Test yourself

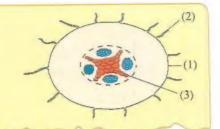
Choose the correct answer: The opposite figure shows a transverse section in a plant root, which of the following part(s) absorb(s) water and salt ions mainly?.....

(a) (1).

(b) (2).

(c) (1), (2).

(d) (1), (3).



Mechanism of water absorption

• This mechanism depends on the following physical phenomena:





Permeability phenomenon

Osmosis phenomenon Imbibition phenomenon

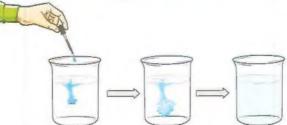
1 Diffusion phenomenon

 It is the movement of molecules or ions from a highly-concentrated medium to a low-concentrated medium, due to the continuous motion of the molecules of the diffused substance.



The diffusion of a drop of ink, when it falls into a beaker containing water.

High concentration of molecules movement Direction of molecules Diffusion



2 Permeability phenomenon

The cell walls and membranes differ according to their permeability, as follows:

Walls and membranes	Ability of permeability	Examples
Permeable :	Allow water and mineral salts to pass.	Cellulose walls.
[mpermeable :	Don't allow water and mineral salts to pass.	Walls covered by lignin or cutin or suberin.



Semi-permeable (Selectively permeable):

- Allow the passage of water.
- Control the permeability of many salts.
- Prevent the permeability of sugars and amino acids, because they are largesized molecules.

Plasma membranes (thin semi-permeable membranes with very tiny pores).

Selective permeability

Is a phenomenon which controls the passage of substances through the plasma membranes, where some substances are allowed to pass freely, and others are passed slowly, while other substances are not allowed to pass at all, according to the plant need.

3 Osmosis phenomenon

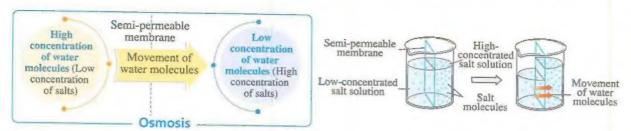
 It is the passage (movement) of water through the semi-permeable membranes from a medium with a high concentration of water molecules (low concentration of salts) to another with a low concentration of water molecules (high concentration of salts).



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Test yourself

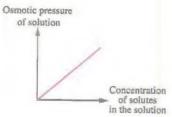
What happens if: the concentration of water in the soil is less than that in the sap vacuole of the root hair?



Osmotic pressure:

Is the pressure that causes the passage of water through the semi-permeable membranes, due to the difference in concentration of the dissolved substances (solutes) in water on the two sides of the membrane.

 The relation between the concentration of solutes in the solution and osmotic pressure of the solution is a directly proportional relationship (i.e. the osmotic pressure increases by increasing the concentration of solutes in the solution).



4 Imbibition phenomenon

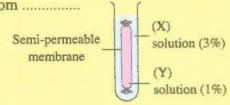
- The plant cell walls absorb water through the solid particles, especially the colloidal ones that have the ability to absorb water, therefore they swell and increase in volume through the phenomenon of imbibition.
- From the examples of hyrophilic colloidal substances in plant :
 - Cellulose.

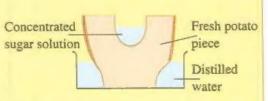
- Pectin.

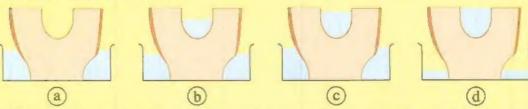
- Protoplasm proteins.

Test yourself

- Give reason: the proteins that are formed by the cells to perform the required vital processes can't pass through their plasma membranes.
- Choose the correct answer:
 - (1) From the opposite figure, the water transfers from
 - (a) (X) to (Y) by osmosis.
 - (b) (Y) to (X) by osmosis.
 - (c) (X) to (Y) by diffusion.
 - d (Y) to (X) by diffusion.
 - (2) The opposite figure shows a piece of fresh potato containing a concentrated sugar solution, was put in a beaker containing distilled water, which of the following figures shows the result of this experiment after 24 hours?.....







- (3) The root hairs in the plants of salty and desert soils are characterized by osmotic pressures that are
 - (a) high in both of them.

- (b) low in both of them.
- c) high in salty plants and low in desert plants.
- d high in desert plants and low in salty plants.
- 3 Explain:
 - (1) In order to get rid of any effects of agricultural insecticides in the fruits, it is advised to soak them in a diluted sugary solution for 10 minutes.
 - (2) Using the tissue papers to dry sweat in summer.

Explanation of water absorption by the root

- 1 The root hairs are covered by a thin colloidal layer to which the soil particles with water membranes and solutes adhere, so that the cellulose and plasma walls will absorb water by imbibition phenomenon.
- Water moves from the soil to the epidermal cells by osmosis phenomenon, where the cellular sap of root hair is more concentrated than the soil solution, due to the presence of sugar dissolved in the cellular sap, (i.e. the water molecules concentration in the soil solution is higher than that in the sap vacuole).
- Water moves by the same method to the cortex cells, until it reaches the xylem vessels in the centre of the root.

Absorption of mineral salts

- The scientists had proved that the plant needs other certain essential elements, besides the carbon, hydrogen and oxygen, and it can absorb these elements through the roots, and their shortage leads to:
 - A disturbance in the plant vegetative growth or its stop completely.
 - The non-formation of flowers or fruits.





- The plant needs these elements in a considerable quantities.

 Their number: they are seven elements, which are initrogen
 - ▶ Their number: they are seven elements, which are: nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and iron.

▶ Their importance :

- The nitrate (NO₃)⁻, phosphate (PO₄)³⁻ and sulphate (SO₄)²⁻ salts work on converting the carbohydrates into proteins.
- Phosphorus enters in the composition of the energy carrier compounds.
- Iron is important for the building up of some co-enzymes which are required for the accomplishment of photosynthesis process.
- Magnesium is required for the synthesis of chlorophyll.
- ▶ The plant needs these elements in a very small quantities that don't exceed a few milligrams per liter. (So, they are also called trace elements).
- ▶ Their number: they are eight elements, which are: manganese, zinc, boron, aluminum, chlorine, copper, molybdenum and iodine.
- Their importance:
 Some of these elements work as activators for the enzymes.

Micro-nutrients

Macro-nutrients



Choose the correct answer:

Which of the following symptoms appears, when the plant grows in a soil that is poor in magnesium element?.....

- (a) Growing of small sized-leaves and many roots.
- (b) Growing of big sized leaves and few roots.
- (c) Increasing the greenness of leaves.
- (d) The leaves turn yellow.

Mechanism of mineral salts absorption

This mechanism depends on the following physical phenomena:

Diffusion phenomenon Selective permeability phenomenon

1 Diffusion phenomenon

- Solute molecules (elements' ions) diffuse independently from each other and from water itself in the form of:
 - Positive ions: called cations, such as K+ and Ca2+
 - Negative ions: called anions, such as (SO₄)²⁻, (Cl)⁻, (NO₃)⁻ and (NO₂)⁻.
- These solutes move by diffusion from the soil solution (high-concentrated medium) and pass through the wet cellulose walls (low-concentrated medium), due to the continuous movement of free ions.
- Under certain conditions, cations exchange may take place through the cell membrane,
 for example:

Sodium (Na+) ion may get out of the cell and be replaced by potassium (K+) ion.

2 Selective permeability phenomenon

 When the ions reach the semi-permeable plasma membrane, some of them are selected and allowed to pass through it, while other ions aren't allowed, according to the plant need, regardless of their size, concentration or charge.

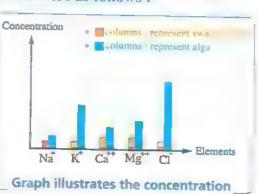
3 Active transport phenomenon

• Sometimes, the ions diffuse from the soil solution, (where the concentration is low) to inside the cell, (where the concentration is high).



Therefore, the presence of chemical energy is needed to force these ions to move against this concentration gradient (i.e. ions diffuse from the low concentration to the high concentration), and the passage of any substance through the cell membrane, when it needs chemical energy is known as active transport.

- On carrying out an experiment on *Nitella* alga (that lives in swamps) to prove the occurrence of active transport process, the results were as follows:
 - 1) The concentration of various ions that are accumulated in the cellular sap of this alga is relatively higher than their concentration in the water of swamp. Such case necessitates that the cell must use up some energy to absorb these ions.
 - The concentration of some ions that are accumulated in the cell is higher than the others, this proves that the ions are selectively absorbed according to the cell need.



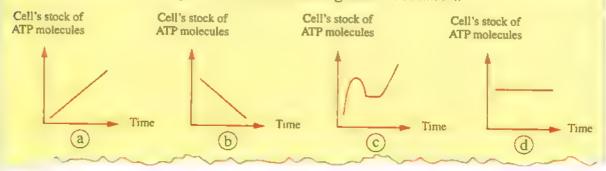
Graph illustrates the concentration of salts in the cells of *Nitella* alga and swamp water

Test yourself

The following table illustrates the concentrations of some salt ions inside the root hair and the surrounding soil:

Ions	The concentration inside the root hair	The concentration in the soil
Magnesium:	75	15
Nitrate:	47	126

Determine the physical phenomena upon which the plant absorption mechanism to these ions from the soil depends.





Autotrophic Nutrition





(Absorption	of Water and Salts)	
The questions signed by	measure the high levels of thinking.	Interactive Tes
Multiple (Choice Questions	
Which of the following use photosynthesis	process to produce their food?	************
Autotrophs. Heterotrophs.	Phototrophs.	(a) and (c).
The food substances that are synthesized in by being compounds.	side the cells of green plant are	characterized
high-energy and simple-structured	low-energy and comple	x-structured
high-energy and complex-structured	J low-energy and simple-	structured
Heterotrophs are characterized by all the fo a obtain their food in the form of organic		. ,
6 obtain their food in the form of high-end	ergy compounds.	
obtain their food in the form of simple-s	-	
depend on other organisms to obtain the	eir food.	
(A) They can't make their own food.		
(B) They are considered consumers in the f	ood chain.	
(C) They depend directly or indirectly on p	lants for food.	
(D) They can utilize sunlight to produce ch	emical energy.	
Which of the previous statements are true f	or heterotrophs?	
(a) (C) and (D).	(b) (A), (B) and (C).	
(A) and (D).	(d) (B), (C) and (D).	
If you know that Ascaris worms can live ar these organisms are	nd feed inside the human small	intestine. So,
(a) saprophytes. (b) autotrophs.	© carnivores.	parasites.
All the following are similar in the mode or	f nutrition, except	
a human.	bread mould fungus.	
© lion.	d deer.	
Root hair cell is characterized by the	from the other normal plan	t cells.
a presence of cell membrane		
b presence of sap vacuole		
c presence of a layer of protoplasm		

d increase of its surface area

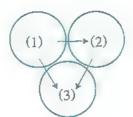
8 The lost root hairs are regenerated from the of the root. permanent zone root hair zone elongation zone growing tip Which one of the following root hairs has the greatest ability to absorb water from the soil? (a) (1). (c) (3). **d** (1) & (3). 10 Which one of the following food substances have the ability to pass through the plasma membranes of cells? (a) Starch molecules. (b) Calcium salts. C Lipids. Large-sized amino acids. 11 The process of mixing two different substances/molecules is a) osmosis. b diffusion. c active transport. d imbibition. 12 Marine fish when thrown under tap water burst, Keys: because of phenomenon. ✓ Endo = absorb. (a) endosmosis **b** exosmosis \checkmark Exo = release. c diffusion d active transport 13 In the opposite figure, an amount of starch solution (10%) concentration is put in the right side and another equal amount of starch solution (6%) concentration is Starch solution put in the left side, what do you expect to happen after 10% passing time ? a Water will transfer from right to left. Semi-permeable membrane 6 Starch will transfer from right to left.

Water will transfer from left to right.

d Starch will transfer from left to right.



- You have two pieces of potato tuber, where the weight of each one of them is 5 g, the first piece is put in a pure water and the second is put in a concentrated sugary solution. What is the expected weight for each one of them after one hour?
 - (a) The first is 6 g and the second is 4 g.
 - (b) The first is 4 g and the second is 6 g.
 - The first and the second are 4 g.
 - The first and the second are 6 g.
- The opposite figure represents the movement of water transfer by osmosis phenomenon between three neighbouring plant cells, which of the following choices represents the correct arrangement for the ability of plant cells to receive water, in descending order?



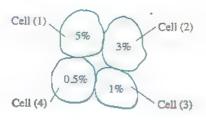
(a) (2), (1), (3).

(b) (2), (3), (1).

(c)(1),(2),(3).

- (1) (3), (2), (1).
- A plant cell was put in a solution, then it takes up water from this solution by osmosis phenomenon. Which of the following represents the concentration of the cellular sap in each of the cell and the solution respectively?
 - (a) 1% and 3%
- (b) 1% and 1%
- © 7% and 2%
- d 2% and 7%

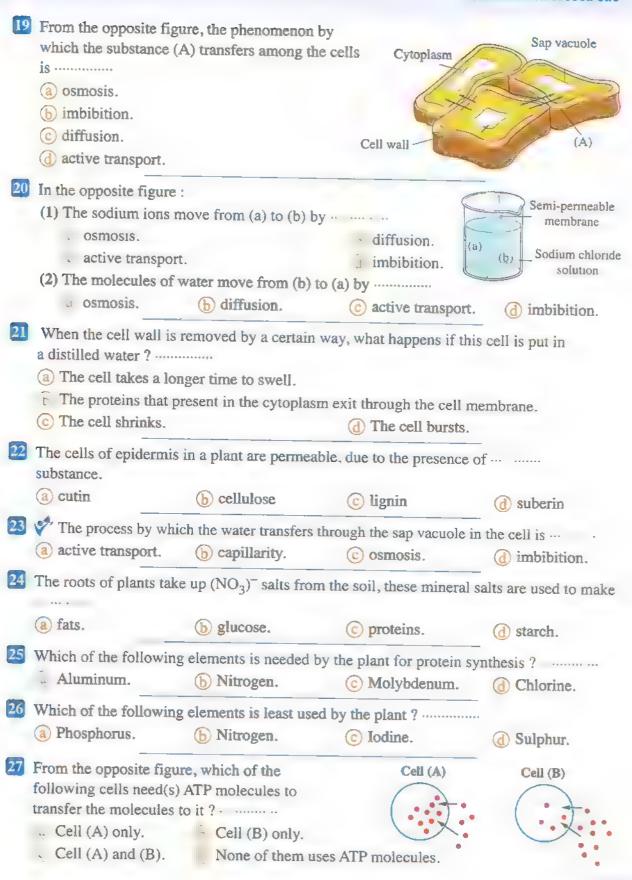
- The opposite figure represents 4 cells that have different concentrations of sugar, the water moves by osmosis from
 - .. cell no. (1) to cell no. (2).
 - cell no. (2) to cell no. (3).
 - © cell no. (3) to cell no. (4).
 - (d) cell no. (4) to cell no. (1).



- A piece of fresh potato is put into a diluted sucrose solution and after an hour, the weight of this piece increases. Which of the results shown in the opposite table represents the concentration of sucrose and the process that occurs?
 - (a)(1).
- **(b)** (2).
- © (3).

d (4).

	The concentration of sucrose	Process
(1)	Decreases	Active transport.
(2)	Increases	Active transport.
(3)	Decreases	Osmosis.
(4)	Increases	Osmosis.





If the concentration of K^+ ions in the swamp water is 1.2×10^3 ion/liter. So, the concentration of these ions in the cellular sap of *Nitella* alga is ... ion/liter.

(a) 1.2×10^3

(b) 0.8×10^3

© 0.12×10^3

(d) 2.1×10^3

29 In the opposite figure:

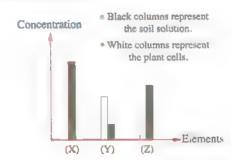
(1) The element (X) is not absorbed, because

a its size is big.

(b) its concentration is very high in the soil.

c the plant doesn't need it.

d this element is from the micro-nutrients.



(2) The plant depends in the absorption of the element (Z) on

(a) osmosis.

(b) diffusion.

c active transport.

d imbibition.

(3) The plant depends in the absorption of the element (Y) on

a osmosis.

(b) diffusion.

c active transport.

d imbibition.

(4) If you know that in case of the absence of the element (Y), the photosynthesis process wouldn't occur. So, it is possible that the element (Y) is element.

(a) iron

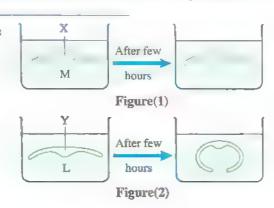
(b) sulphur

c nitrogen

(d) calcium

- (5) The presence of element (Y) in a higher concentration than that of the element (Z) in the plant cells, confirms that
 - (a) the plant needs the element (Y) more than the element (Z).
 - (b) the absorption of the two elements occurred by diffusion.
 - the first element is absorbed by diffusion and the second is absorbed by active transport.
 - the first element is absorbed by active transport and the second is absorbed by diffusion.
- 30 (X) and (Y) represent two identical transverse sections in a plant leaf, (X) was put in sugar solution (M) as shown in figure (1), while (Y) was put in sugar solution (L) as shown in figure (2), we can deduce from the two figures that the

(a) concentration of solution (M) equals that of solution (L).



Y Z

- 5 concentration of solution (M) is higher than that of solution (L).
- concentration of solution (L) is lower than that of solution inside the sap vacuoles of (X) cells.
- J concentration of solution (M) equals to that of the solution inside the sap vacuoles of (Y) cells.
- In the opposite figure:
 - (1) The molecules ----- can transfer from -----
 - (a) (X) and (Z) / solution (1) to solution (2).
 - (b) (Y) / solution (1) to solution (2).
 - © (X) and (Z) / solution (2) to solution (1).
 - (d) (X) and (Y) / solution (2) to solution (1).
 - (2) After 24 hours the solution will have the concentration %
 - (a) first / 9
- (b) second / 8
- d) second / 5

Solution (2)

concentration

Solution (1)

concentration

(8%)

Semi-permeable

membrane

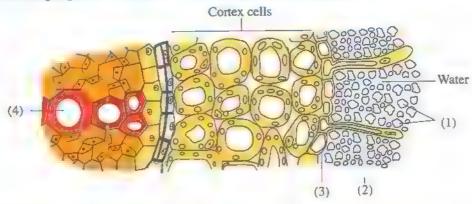




- "Cotton plant is autotrophic, while bread mould fungus is heterotrophic". Explain.
- 2 What is the difference between: bean plant and Orobanche plant?
- 3 Explain: the green plant doesn't benefit from the carbohydrates resulted from the lysis of plant leaves that present in the soil.
- The opposite figure illustrates an important structure in the plant root:
 - (a) What is the change that may occur to the structures no. (1) and (3) in case of the continuous root growth?
 - (b) What happens to the ions concentration in the structure no. (2), on increasing the time between irrigation periods?
- (3)
- (c) Predict what happens in case of the absence of structure no. (3) from the plant root.
- "The root hair works as an osmotic instrument". Explain.

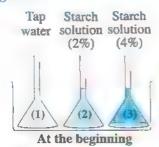


6 The following figure illustrates a T.S. in the root of a plant:



- (a) Deduce the labels from no. (1): (4).
- (b) Illustrate by arrows on the figure the path of water transfer from the structure no. (1), till reaching the structure no. (4) in the centre of root by osmosis phenomenon.
- (c) Explain how the presence of structure no. (2) helps to:
 - 1. Penetrate the structure no. (1).
 - 2. Increase the efficiency of water and salts absorption from the structure no. (1).
- (d) What happens if the nitrate, sulphate and phosphate salts are absent from the structure no. (1)?
- (e) The production of ATP molecules needs the presence of oxygen, deduce what happens if the structure no. (1) is immersed with water for a relatively long time.
- "The cell walls are characterized by the selective permeability phenomenon".

 How far this statement is correct? With explanation.
- Three funnels contain starch solutions with different concentrations, were put for 24 hours in a container containing starch solution with unknown concentration, and the end of each funnel is covered with a semi-permeable membrane. As shown in the following figure:





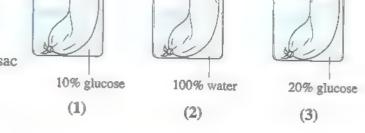
After 24 hours

- (a) What is the concentration of the solution inside the container? Explain your answer.
- (b) Explain the change occurring in the two funnels no. (1) and (3).

10% glucose

- In the opposite figure, a cellulose sac was put as shown in the cases (1), (2) and (3);
 - (a) Deduce the concentrations of each of the following:
 - 1. Water inside the cellulose sac in case no. (1).
 - 2. Water inside the solution in case no. (3).



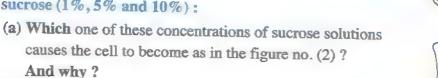


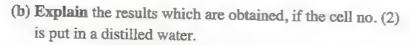
20% glucose

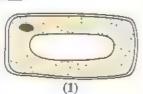
(b) Show by arrows the direction of water movement in each case, with explanation.

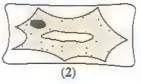
10% glucose

In the opposite figure, if you know that the osmotic pressure of the plant cell is equivalent to 5% sucrose solution, and this cell was put in solutions with different concentrations of sucrose (1%, 5% and 10%):



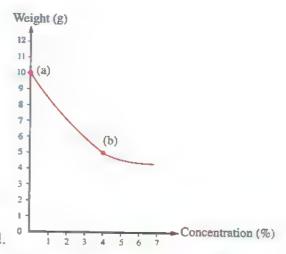






- The opposite graph illustrates the results of an experiment that was carried out on pieces of potato with equal weights (7 g), then some of them were put in water and the others were put in sucrose solutions with different concentrations:
 - (a) Explain the results at the two points (a) and (b).
 - (b) Which one of the sucrose solutions has the same concentration of the cellular sap in the potato cells? And why?

(c) Explain why the curve is constant at its end.



In the opposite figure, when irrigating the plant in figure no. (1) with a highly concentrated salt solution, it changed into figure no. (2) after passing several hours, deduce the reason for the plant wilting.





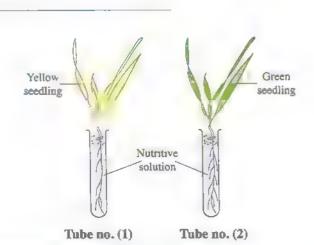
- 13 What is the relation between: osmosis phenomenon and osmotic pressure?
- "Active transport is arisen from the difference of osmosis between the plant cells".

 How far this statement is correct? With explanation.
- "Cytoplasm in each of the plant cell and animal cell is surrounded by a plasma membrane and the plant cell is characterized by the presence of a cell wall that is not found in the animal cell".

In the light of this, what happens in each of the following two cases:

- (a) The plant cell is immersed in a solution whose osmotic pressure is low (1%) related to the cell concentration.
- (b) The animal cell is immersed in a solution whose osmotic pressure is low (1%) related to the cell concentration.
- Give reason: the cell consumes energy to absorb the ions against the concentration gradient.
- two seedlings are planted in two different nutritive solutions with exposing them to the same conditions.

 Explain the difference between the colour of the two seedlings in the two tubes no. (1) and (2).



18 Study the following table, then mention the type of each living organism, according to the way of obtaining food:

Organism (X)	Takes simple raw materials from the environment and converts them into complex organic substances.
Organism (Y)	Lives inside the alimentary canal of another organism and feeds on the digested food of this organism.
Organism (Z)	Lives in the soil and feeds on the bodies of dead organisms.



econd

Photosynthesis process

• The green leaves are considered the main sites for photosynthesis process in the higher plants, as they contain chloroplasts.



 The green herbaceous stems may participate, to some extent, in photosynthesis process, as they contain chlorenchymatous tissues which contain chloroplasts.

Do you know ... ? ___

• Chlorenchymatous tissues are parenchymatous tissues containing green chlorophyll.

Chloroplast

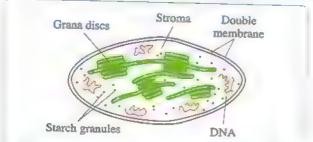
• Its structure :

After studying the chloroplast under the electron microscope, it was found that it consists of:



Note

The green plastids (chloroplasts) in higher plants appear under the light microscope as a homogeneous mass, having the shape of convex lens.



- Diagram of chloroplast (highly magnified)
- ① Double thin external membrane: its thickness is about 10 nanometers.
- 2 Matrix (Stroma): consists of a colourless protein substance.



3 Starch granules:

- They spread in the stroma with large numbers.
- They are small in size, as they will soon change back into a soluble sugar that translocated to other organs of the plant under certain conditions.

Grana:

- They are embedded in the stroma.
- They are disc-shaped structures arranged along the body of plastid, where they are linked together by thin membranes.
- Each granum is about 0.5 micron in diameter and about 0.7 micron in thickness.
- Each granum consists of 15 hollow discs or more that are arranged above each other and the granum is hollow from the inside, while the margins of some discs of a granum may extend to meet the margins of another disc of a neighbouring granum to increase the surface area of grana that are exposed to the light.
- They are responsible for carrying the pigments which absorb the light energy.

• The main pigments in the chloroplast:

Pigment	Colour	Ratio is about
Chlorophyll (A)	Blue-green	70%
Chlorophyll (B)	Yellow-green	
Xanthophyll	Lemon-yellow	25%
Carotene	Orange-yellow	5%

Note

The green colour dominates over the other colours of pigments in the chloroplast, due to the high ratio of chlorophyll pigments.

Do you know ...?

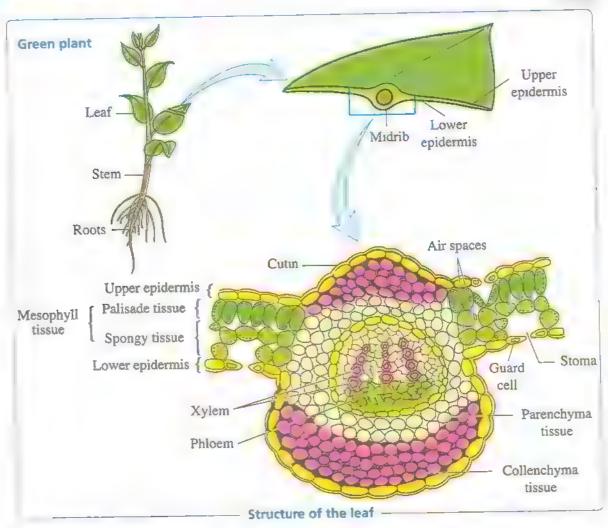
- Chlorophyll (A) and (B) are considered from the main pigments that are responsible for absorbing most of the light needed for accomplishing the photosynthesis process.
- Xanthophyll and carotene are considered from the accessory pigments that absorb a little amount of light, then transfer it to chlorophyll (A), increasing the efficiency of photosynthesis process.

- The importance of chlorophyll: it absorbs the light energy required for the photosynthesis process.
- The structure of chlorophyll:
 - It is a complicated structure and the molecular formula of chlorophyll (A) is $\mathrm{C}_{55}\mathrm{H}_{72}\mathrm{O}_5\mathrm{N}_4\mathrm{Mg}$
 - It is believed that there is a relation between the presence of magnesium (Mg) atom in the centre of chlorophyll (A) molecule and the ability of chlorophyll to absorb the light.

7	est yourse		of	chlorophyll to absorb the light.
6	Explain :			
	(2) The color	ars of peppers are varie	ed between dark green	microscope as a convex lens
C	The opposite of pigments study it, then (1) The most photosynth (a) X (c) Z (2) Which of the of chloropy	that present in a leaf that present in a leaf the choose the correct a light energy that need the chesis process is absort	e percentages of a plant, unswer: ed for oed by b Y d X,Y offects the effeciency	Percentage (%) 100 90 80 70 60 50 10 0 X Y Z
	(a) Mg	(b) K	© Na	(d) CI
	(3) Which of t plant?	hese pigments is foun	d in a large percentag	e in the roots of carrot
	a X	(b) Y	©Z	d Y,Z
	(4) Which of the olitorius "n	hese pigments is found nolokhia" plant ?	d in a large percentage	e in the stems of Corchorus
	(a) X	(b) Y	©Z	③ X,Y

(Atmosphere) the heaft





• The leaf consists of three main tissues, which are:

1 Upper and lower epidermis

- Each of the upper and lower epidermis consists of one layer of adjacent barrel-shaped parenchyma cells that are devoid of chlorophyll.
- The external wall of each epidermis is coated by a layer of cutin, except the stomata that spread throughout the epidermal cells.

2 Mesophyll tissue

• It lies between the upper and lower epidermis, transversed by veins and consists of :

Palisade layer

- Spongy layer
- It is perpendicular to the surface of upper epidermis.
 - It is located below the palisade layer.
- It consists of one row of cylindrical and elongated parenchyma cells.
- It consists of irregular-shaped and loosely-arranged parenchyma cells with wide intercellular spaces.
- Its cells possess many chloroplasts that arrange themselves in the upper part of cells, to receive the largest amount of light rays.
- Its cells contain a lower number of chloroplasts than the palisade cells.

3 Vascular tissue

- It consists of numerous vascular bundles which extend inside the veins and venules, and the main vascular bundle of the leaf is found in the midrib.
- The vascular bundle consists of :
 - Xylem vessels: found in several vertical rows that are separated by xylem parenchyma (thin-walled) cells.
 - Phloem:
 - It follows the xylem toward the lower surface of leaf.
 - It translocates the dissolved organic food substances that are formed in the mesophyll tissue to the different parts of the plant.

Test yourself

Choose the correct answer:

If the magnesium element is detected in a leaf of a plant, it will be found in the cells of . in an excess amount.

a upper epidermis

b lower epidermis

© palisade layer

- d spongy layer
- Cutin layer is absent in aquatic plants, while its thickness increases in the desert plants. Explain this.



Mechanism of photosynthesis

Source of oxygen evolved during photosynthesis process

 The American scientist "Van Neil" was the first person who pointed out the source of oxygen evolved in photosynthesis process through his studies to this process in the green and purple sulphur bacteria.



Van Neil

Green and purple sulphur bacteria

Sulphur bacteria are characterized by :

- 1 Being autotrophic: as they can synthesize their food by a bacteriochlorophyll (which is simpler in structure than the normal chlorophyll).
- Living in swamps and ponds: as hydrogen sulphide is abundant which is the source of hydrogen that is used by these bacteria to reduce CO₂, in order to build up carbohydrates substances and sulphur is released.

Van Neil assumed that :

- Light decomposes hydrogen sulphide into hydrogen and sulphur in light reactions.

- The resulted hydrogen reduces carbon dioxide into carbohydrates in dark reactions .

So, the general chemical equation for photosynthesis in sulphur bacteria is

2 Green plants

Van Neil assumed that :

- Light decomposes water into hydrogen and oxygen in light reactions :

- The resulted hydrogen reduces carbon dioxide into carbon a stes in dark reactions :

$$12H_2 + 6CO_2$$
 Reduction $C_6H_{12}O_6 + 6H_2O$

So, the general chemical equation for photosynthesis in green plants is:

$$6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow{\text{Light energy}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O} + 6\text{O}_2$$

 Consequently, Van Neil proposed that water is the source of oxygen in green plants, as well as hydrogen sulphide is the source of sulphur in sulphur bacteria.

Confirming the theory of Van Neil

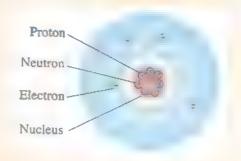
 To confirm that water is the source of oxygen that evolved from the photosynthesis process:

In 1941, a group of scientists at California university carried out experiments to verify the theory of "Van Neil", where they used the green *Chlorella* alga and provided it with all the suitable conditions for accomplishing the photosynthesis process.

	First experiment	Second experiment
Steps:	Using water contains oxygen isotope ¹⁸ O instead of ¹⁶ O	Using normal water with carbon dioxide contains ¹⁸ O isotope
Observations:	The evolved oxygen from photosynthesis is ¹⁸ O isotope.	The evolved oxygen from photosynthesis is normal oxygen ¹⁶ O
Equation of the reaction:	$ \begin{array}{c} 6C^{16}O_2 + 12H_2^{18}O \xrightarrow{\text{Light energy}} \\ C_6H_{12}^{16}O_6 + 6H_2^{16}O + 6^{18}O_2 \end{array} $	$\frac{6C^{18}O_{2} + 12H_{2}^{16}O}{C_{6}H_{12}^{18}O_{6} + 6H_{2}^{18}O + 6^{16}O_{2}}$
Conclusion:	The source of evolved oxygen from pl dioxide.	notosynthesis is water and not carbon

Do you know ... ?___

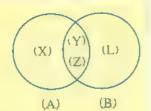
- Isotopes are forms of a chemical element that has the same atomic number (the number of protons inside the nucleus or the number of electrons that revolve around it), but they differ in the mass number (the sum of protons and neutrons inside the nucleus), due to the difference in neutrons number.
- Example: oxygen has three stable isotopes which are: 16O, 17O, 18O



Test yourself

The apposite figure represents the products of photosynthesis process of two living organisms (A) and (B).

If you know that:



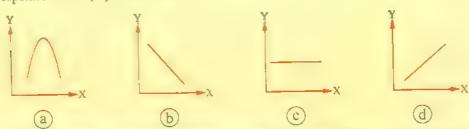
- (A) Is an autotrophic organism that lives in a salty swamp that is rich in sulphur element.
- (B) Is an autotrophic organism that lives in a mud soil.

In the light of this:

- (1) Suggest an example for each of the aving organisms (A) and (B).
- (2) Determine each of the following (X). (Y), (Z) & (L)

Choose the correct answer:

(1) Which of the following graphs illustrates the relation between the percentage of presence of purple sulphur bacteria (Y) in swamps water and the sulphur that precipitated in it (X)?



- (2) When using carbon dioxide containing oxygen isotope (¹⁸O) in the photosynthesis process. Which one of the following will contain the oxygen isotope (¹⁸O) in the products of reaction?
 - (a) Glucose only.
- (b) Glucose and water.

© Water only.

d Water and evolved oxygen.

Light and dark reactions of the photosynthesis process

- In 1905, "Blackman" explained through his experiments to study the limiting factors for the photosynthesis rate, such as light, temperature and carbon dioxide, that photosynthesis process is divided into:
 - Light reactions (sensitive to light).
 - Dark reactions "Enzymatic reactions" (sensitive to temperature).



Blackman

First

Light reactions

Light reactions

Are a group of reactions that occur in the grana inside the green plastid (chloroplast), as it contains the chlorophyll pigments, and the light is the limiting factor for the rate of these reactions.

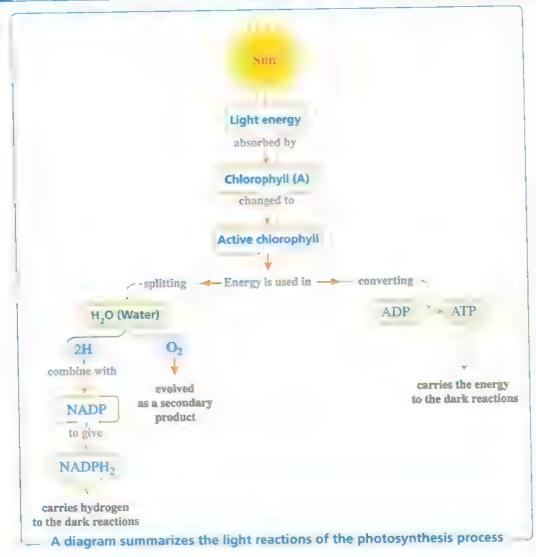
Light reactions occur in a chain of steps, as follows:

- 1 Light falls on the chlorophyll that presents in the grana of chloroplast, therefore the electrons in the atoms of chlorophyll molecule will gain energy. So, they are shifted up (transferred) from their low-energy levels to the higher ones.
- 2 The kinetic energy of light is stored as a chemical potential energy in the chlorophyll. So, the chlorophyll molecules in which their electrons have reached this condition are said to be in an "excited state" or "activated state".
- When the stored energy in chlorophyll is released, the electrons fall once again to the lower energy levels and the chlorophyll will return to the stable state, being ready for another influence of light to become excited once more.
- Part of the energy released from the excited chlorophyll is used in splitting up the water molecule into hydrogen and oxygen, where:
 - Hydrogen combines with a coenzyme (hydrogen receptor) that presents in the chloroplast and symbolized by NADP to give NADPH₂, in this way hydrogen will not escape or recombine with oxygen again.
 - Oxygen is released as a secondary product.
- The other part of energy released from the excited chlorophyll is stored in ATP molecule by the combination of ADP molecule (which presents in chloroplast) with a phosphate group (PO₄)³⁻, and this process is called "photosynthetic phosphorylation".

Adenosine
$$-P \sim P + P$$
 $\stackrel{E}{\longrightarrow}$ Adenosine $-P \sim P \sim P$

- ADP: Adenosine DiPhosphate.
- Adenosine TriPhosphate that carries the energy to the dark reactions.
- NADP: Nicotinamide Adenine Dinucleotide Phosphate.





Test yourself

Mat happens in case if:

- (1) The decrease of soil water that is absorbed by the plant, 'according to the photosynthesis process".
- (2) The absence of NADP from chloroplast during the light reactions.

Second

Dark reactions

Dark (Enzymatic) reactions

Are a group of reactions that occur in the stroma (matrix of chloroplast) outside the grana, in which the temperature is the limiting factor for the rate of these reactions. So, these reactions can occur in either light or darkness.

- In these reactions, carbon dioxide gas is fixed by its combining with the hydrogen carried on NADPH, compound with the help of the energy stored in ATP molecules, therefore carbohydrates are formed, and so NADPH2 and ATP compounds are called energy-fixing compounds.
- In 1949, "Melvin Calvin" and his associates at California university revealed the nature of dark reactions by using the newly discovered radioactive isotope of carbon (14C).



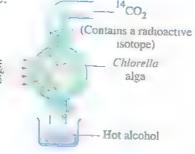
Melvin Calvin



Experiment Metric Carlo

1. Steps:

- (1) Chlorella alga was put in the apparatus shown in the figure.
- (2) He supplied the alga with CO, gas containing the radioactive carbon (14C).
- (3) The apparatus was exposed to a very brief light of lamp to allow the photosynthesis process to take place.
- (4) Chlorella was then immersed in a beaker containing hot alcohol to kill the cell and stopping the biochemical reactions.



(5) He managed to separate the compounds that formed during photosynthesis process (by special means) and tested for the radioactive carbon in these compounds by using Geiger counter.

2. Results:

- (1) A compound with three carbon atoms (3C) was formed which is called 'phosphoglyceraldehyde PGAL' (after two seconds only from exposing to light) and it is .
 - The first stable chemical compound produced from photosynthesis process.
 - Used in building glucose, starch, proteins and fats.
 - Used in the cellular respiration as a high-energy compound.
- (2) Proving that the hexose sugar (glucose) is not synthesized in one step, but it is synthesized through several intermediate reactions catalyzed by certain specific enzymes.



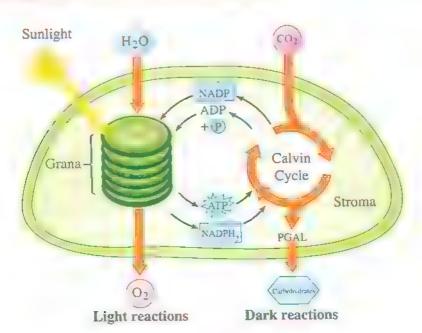
5

Test yourself

- Which of the following substances is produced by the corn plant in a direct way and which is produced in an indirect way from the photosynthesis process? (Corn oil Corn starch Glucose). Explain your answer.
- During the photosynthesis process, two molecules of phosphoglyceraldehyde are used to build up one molecule of glucose. Explain this.

From the previous, we can:

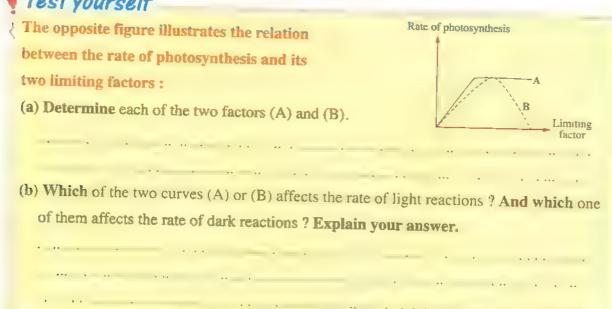
• Summarize the mechanism of occurrence of light and dark reactions in chloroplast, as shown in the following diagram:



Compare between the light and dark reactions, as follows:

P.O.C.	Light reactions	Dark reactions
Site of occurrence :	In grana.	In stroma (matrix of chloroplast).
The limiting factor:	Light	Temperature
What happens in this process:	Conversion of the kinetic energy of light into a chemical potential energy in the chlorophyll.	Fixation of CO ₂ by its combination with hydrogen that is carried on NADPH ₂ compound, by the help of ATP
Products :	 Hydrogen combines with NADP, forming NADPH₂ Oxygen gas (secondary product). Energy stored in ATP molecule. 	- PGAL compound that is used in building glucose, starch, proteins and lipids, also used as a high-energy compound in the cellular respiration Water.

Test yourself





Continue: Autotrophic Nutrition

(Photosynthesis in Green Plants)



The questions signed by 🥙 measure the high levels of thinking.

Interactive Test

The stems of herbaceo	us <mark>plants are chara</mark> cte	rized b	y the presence	of	tissues.
comparing with the ste					
a parenchymatous			(b) colle	nchymatous	
© sclerenchymatous			d chlor	enchymatous	
When exposing a plan	t to a sunny day, whi	ch of th	e following do	oes the rate of	f its
releasing out from the	leaf increase?	***			
(a) CO ₂	(b) O ₂		© N ₂	(\mathbf{d} \mathbf{H}_2
		1	a subsah of th	e following d	oes
When exposing a plan				c ronowing o	
the rate of its releasing a CO ₂	g out from the leaf in (b) O ₂	crease (© N ₂		∂ H ₂ O
the rate of its releasing a CO ₂	g out from the leaf in (b) O ₂	olant are	© N ₂	(to water, du	d H ₂ O e to
the rate of its releasing a CO ₂ The walls of epiderms the deposition of a cutin.	al cells in a leaf of a p b cellul c shows the	olant are	© N ₂	(to water, du	d H ₂ O e to d suberir
the rate of its releasing a CO ₂ The walls of epiderms the deposition of a cutin. The opposite table	al cells in a leaf of a probability of the cellule shows the ts in three types	olant are	© N ₂ e impermeable © pect	in. Palisade	d H ₂ O e to d suberir
the rate of its releasing a CO ₂ The walls of epiderms the deposition of a cutin. The opposite table number of chloroplas	al cells in a leaf of a position. (b) Cellule shows the ts in three types ionous plant le f.	olant are	© N ₂ e impermeable © pect	in. Palisade layer	d H ₂ O e to Spongy layer
the rate of its releasing a CO ₂ The walls of epiderms the deposition of a cutin. The opposite table number of chloroplas of cells in a dicotyled	al cells in a leaf of a p b cellul c shows the ts in three types ionous plant le	olant are	© N ₂ e impermeable © pect Epidermis Zero	in. Palisade layer	d H ₂ O e to Spongy layer 6
a CO ₂ The walls of epiderms the deposition of a cutin. The opposite table number of chloroplas of cells in a dicotyled which of the following	al cells in a leaf of a p b cellul c shows the ts in three types ionous plant le	olant are	© N ₂ e impermeable © pect Epidermis Zero	Palisade layer 17 Zero	d H ₂ O e to Spongy layer 6

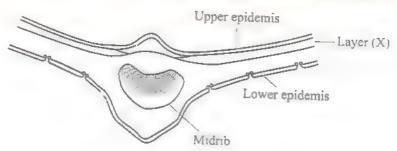
a Palisade tissue.

© Xylem tissue.

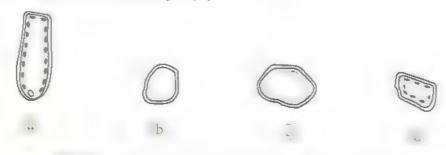
b Spongy tissue.

d Phloem tissue.

7 The following figure shows a cross-section in a part of the plant leaf:



Which type of cells is found in layer (X)?



- In green and purple sulphur bacteria, the occur in the light and dark reactions respectively.
 - a formation of hydrogen sulphide and splitting of water
 - b evolving of oxygen and formation of water
 - © splitting of hydrogen sulphide and formation of water
 - d splitting of water and formation of hydrogen sulphide
- The number of hydrogen atoms resulted from the photolysis of 6 molecules of water is atoms.

a 6

b 12

© 18

d 24

The number of oxygen molecules resulted from the photolysis of 12 molecules of water is ... molecules.

(a) 2

6

9

. 12

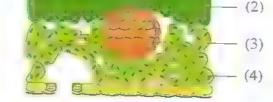
- In the opposite figure:

a (1),

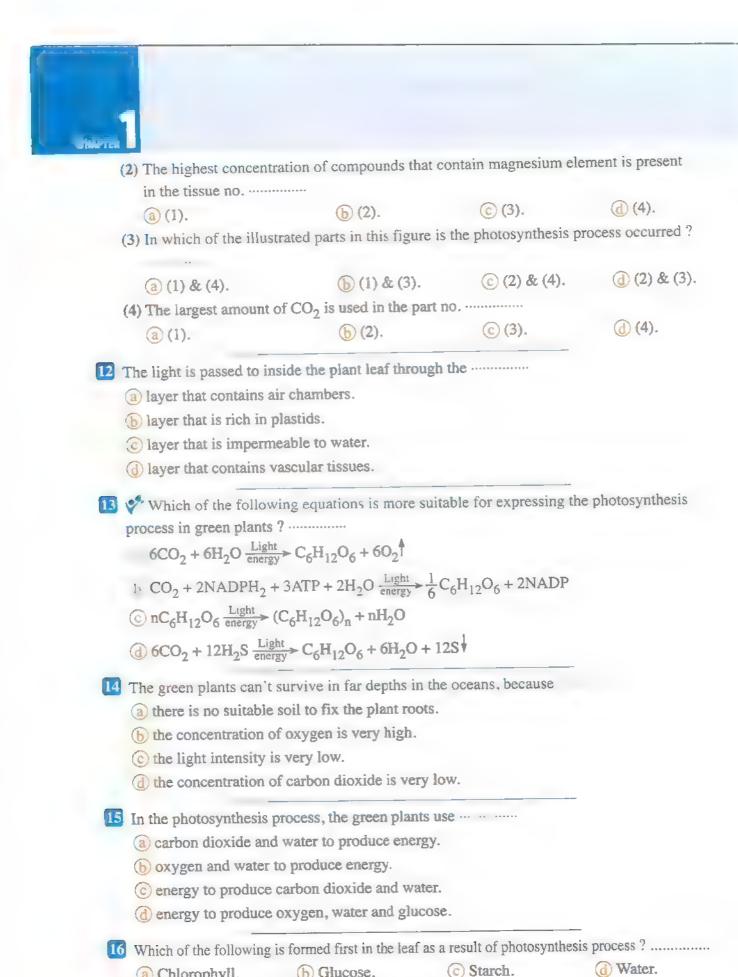
h (2).

© (3).

(4).



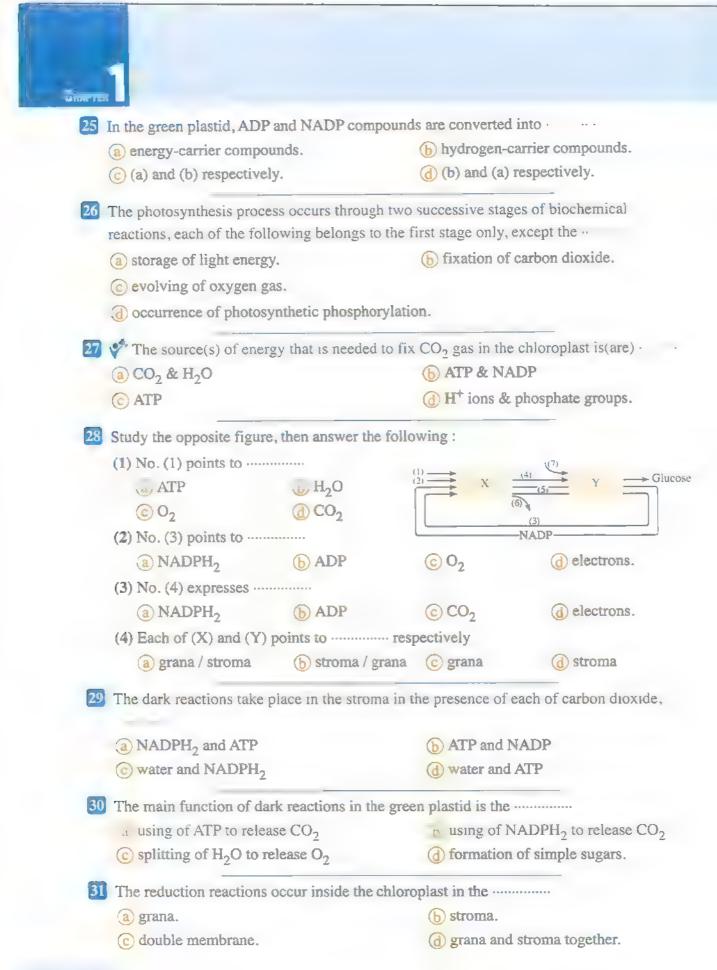
(1)



(b) Glucose.

a Chlorophyll.

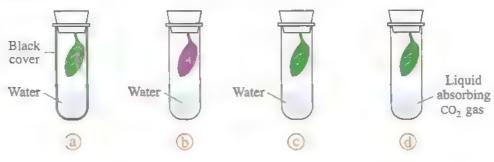
17 Which product of photosynthesis moves out of a green leaf through its stomata? (a) Carbon dioxide. (b) Glucose. © Oxygen. Water. Which of the following equations represents the nutrition process in the following figure? a B + D Sunlight A + C (b) A + C Sunlight B + D C A + C Sunlight A + D \bigcirc A + B + D Sunlight B + C 19 The absorption of light energy that is required for the photosynthesis process occurs by the a water molecules. **b** stroma. chlorophyll molecules. (d) starch granules. 20 Oxygen is released from the photosynthesis process during the a light reactions only. b dark reactions only. light and dark reactions together. enzymatic reactions only. Water in the products of the equation $(6CO_2 + 12H_2O \longrightarrow C_6H_{12}O_6 + 6H_2O + 6O_2)$ is formed during the a light reactions. b dark reactions. photosynthetic phosphorylation. d light and dark reactions. 22 The opposite process for the photosynthetic phosphorylation process is the production of (a) ATP from ADP in grana. (b) ADP from ATP in grana. © ATP from ADP in stroma. d ADP from ATP in stroma. 23 In the photosynthetic phosphorylation process, the green plants use a light + water + chlorophyll. \bigcirc CO₂ + ADP + light. c light + chlorophyll + ADP \bigcirc water + CO₂ + ADP 24 If NADP compound is absent during the light reactions, ... a the process of water splitting will not occur. b hydrogen will not be transferred to the stroma. © CO2 gas will not be fixed. the energy will not be carried to the dark reactions.

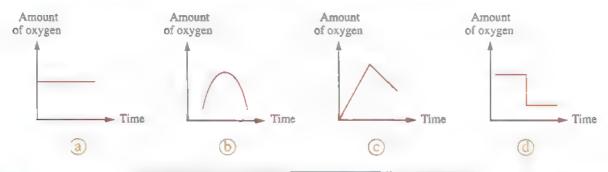


32	The presence of N	NADPH ₂ compounds in	the stroma of chloropla	ist is an evidence for
	the occurrence of	each of the following,	except the	
	a splitting of wa		b formation of	ATP
	© formation of A	ADP	d evolving of	
33	The reaction that	occurs in stroma and do	esn't occur in grana is t	he · ··
		3-carbon compound.		
	b conversion of	NADP into NADPH ₂		
	© splitting of wa			
	d conversion of	ADP into ATP		
34	In the dark reaction	ns of photosynthesis proc	ess. PGAL compound is	formed from the · · ·
	a combination of	f carbon dioxide with w	ater.	
	b combination o	f carbon dioxide with h	ydrogen.	
	© production of			
	_	en carbon dioxide and c	chlorophyll	
35	molecule is	osphoglyceraldehyde m b 3	© 4	d 5
36	Which of the follo	wing compounds doesn	t agree with the dark re	eactions ?
	(a) ADP	ⓑ C ₆ H ₁₂ O ₆	© O ₂	(d) NADP
37	All the following	compounds are produce	d, when exposing the C	hlorella alga to the light
	for two seconds of	nly, except		
	a NADPH ₂	(b) ATP	© PGAL	$\bigcirc C_6H_{12}O_6$
38	In a photosynt	hesis experiment, a plan	t is left in bright sunligh	
	for several hours.	A leaf is then removed f	rom the plant and tested	White area
		; iodine solution. The op		
	the leaf removed f	rom the plant that was u	sed in this experiment.	Green area
	Which figure sho	ws the result of this exp	eriment?	Orean area
	plans.	A Stories		lodine solution
				lodine solution
				stays brown
	(a)	(b) (c)	d	

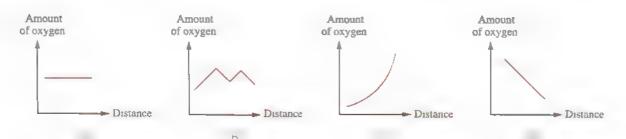


During the detection of the photosynthesis experiment, four plant leaves were exposed to the Sun and after 24 hours they were tested for starch. Which of the following test tubes is used to confirm whether the chlorophyll is essential for the photosynthesis process or not?





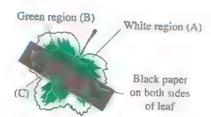
Which of the following graphs shows the amount of oxygen resulted, if the source of light was moved gradually and slowly away from a green plant through a continuous 24 hours of exposure?



From the following table, which one of the choices summarizes the photosynthesis process?

The conversion of energy	The product of photosynthesis	The storage form
From chemical to light	Glucose	Starch
From chemical to light	Starch	Glucose
From light to chemical	Glucose	Starch
From light to chemical	Starch	Glucose

A plant with variegated leaves, the starch has been removed from its leaves by placing it in a dark cupboard for 48 hours. A black paper is then fixed on one leaf as shown and the plant is exposed to light. After 24 hours, which part(s) of the leaf contain(s) starch?



(A).

(b) (B).

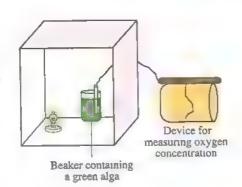
© (C).

d All of them.

- The source of glucose that presents in the cellular sap of the root hair is
 - absorbed from the soil by active transport.
 - b resulted from the catabolism.
 - © resulted from the photosynthesis process.
 - resulted from the catabolism and photosynthesis processes.
- Customers in a restaurant observed that one of the dark potted plants inside the restaurant was growing more and greener than the other plants, a customer asked the owner of the restaurant about the reason, and he answered that he put soda water in the pot of this plant. So, it can be explained that the
 - . soda water makes the soil more alkaline, leading to an increase in the plant growth.
 - temperature of soda water increases the rate of plant growth.
 - evolved oxygen from soda water increases the plant growth.
 - soda water makes the soil moist and the leaves of plant absorb CO₂, increasing the rate of plant growth.



In an experiment to study the effect of light intensity on photosynthesis process, a student put a beaker containing a green alga and electric lamp inside a closed box, and he estimated the concentration of oxygen inside the beaker, after that he started to reduce the light intensity for several times and in each time he recorded the concentration of oxygen inside the beaker, and the results were represented in the following graph. Study it, then answer:

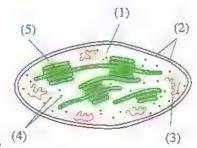


- (1) The rate of resulted oxygen equals the rate of consumed oxygen in the period from
 - (a) to (b).
- (b) to (c).
- (c) (c) to (d).
- (d) to (e).
- Time (hour)
- (2) By increasing the rate of oxygen production, the rate of production increases.
 - a C6H12O6
- (b) ATP
- © NADPH₂
- d CO₂

_

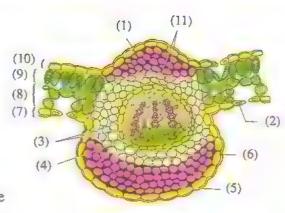
Miscellaneous Questions

- Give reason: the stem of Corchorus olitorius "molokhia" plant has the ability to do the photosynthesis process.
- 2 In the opposite figure :
 - (a) Determine the types of main pigments that present in structure no. (5).
 - (b) Explain how the processes happening in the structure no. (1) are integrated with that occurred in the structure no. (5).

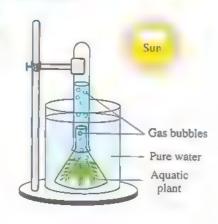


- (c) Mention the number and name of the structure that:
 - 1. Presents also in the cell nucleus.
 - 2. Consists of colourless protein substance.
 - 3. May disappear under certain conditions.

- 3 From the opposite figure:
 - (a) Deduce the functional sutability of the structure no. (9).
 - (b) Determine the numbers that represent :
 - Two different types of living and non-living cells that participate in the formation of a compound tissue.
 Explain your answer.
 - Two similar types of cells that participate in performing the same function. Explain your answer.



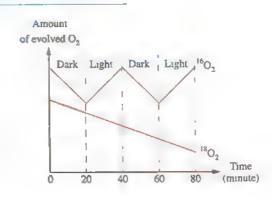
- (c) In your opinion, why does the structure no. (7) differ from the structure no. (10)?
- What happens in case of: the absence of grana from the chloroplasts in a plant?
- 5 What is the relation between: the molecular structure of chlorophyll and the efficiency of photosynthesis process?
- What happens in case of: growing of a plant in a soil that is devoid of magnesium element?
- 7 Explain: the upper surface of leaf is more green than its lower surface.
- 8 What happens in case of: the absene of phloem tissue from the plant leaf?
- "Oxygen is always resulted from the photosynthesis process in the autotrophic organisms". How far this statement is correct? With explanation.
- 10 The opposite figure shows an experiment to prove that the green plant performs photosynthesis process:
 - (a) Mention the mistake(s) in the opposite experiment, with explanation.
 - (b) After correcting the mistake(s), predict what happens in case of :
 - 1. Replacing the aquatic plant with a type of aquatic bacteria. Explain your answer.
 - 2. Exposing the opposite experiment to an electric lamp instead of the sunlight.





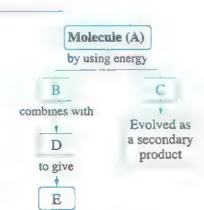
- "All types of bacteria are autotrophic".

 How far this statement is correct? With explanation.
- The opposite graph illustrates the change in the concentration of two oxygen isotopes in the surrounding medium of a unicellular green alga, that was placed in a water containing (H₂¹⁶O) and mineral salts, where into water oxygen (¹⁸O₂) is dissolved and also a source of carbon dioxide (C¹⁸O₂) after exposure to light and dark periods:



- (a) Explain the difference in the concentration of ¹⁶O₂ during the experiment which takes 80 minutes.
- (b) Explain the decrease in the concentration of ¹⁸O₂ during the same time of experiment.
- "The scientists used some of the isotopes in illustrating the mechanism of photosynthesis process". How far this statement is correct? With explanation.
- What happens in case of: exposing the sulphur bacteria to a shortage in the hydrogen sulphide?
- "Dark reactions in the plant don't need co-factors".

 How far this statement is correct? With explanation.
- The opposite diagram illustrates a part of the important reactions that occurred inside the green plant, in the light of this, answer the following:
 - (a) In which part of the plant are the illustrated reactions in this diagram occurred?
 - (b) What happens to (B), when (D) is absent? And what happens to the green plant?
 - (c) Expect what happens if (E) is not formed?



- 17 Explain: the chlorophyll molecules work as energy convertor devices.
- "ATP molecules are formed from the light energy directly".

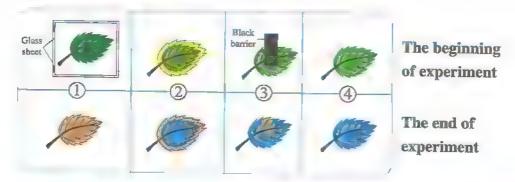
 How far this statement is correct? With explanation.

In the opposite figure, a leafy plant was exposed to the sunlight with putting a part of one of its leaves inside a glass jar that contains a concentrated solution of potassium hydroxide, and the other part was exposed to light, and after several hours, it was tested for the formation of starch by using iodine solution on the two parts of the leaf. What do you expect to happen? Explain your answer.



- "The occurrence of light reactions depends on the occurrence of dark reactions".

 How far this statement is correct? With explanation.
- The following table shows the exposure of 4 plant leaves to the light for several hours under different conditions, as follows:



And on detecting the starch by using iodine solution, the following was noticed:

- (a) The iodine solution didn't change in the case no. (1).
- (b) The iodine solution is changed in some places in the two cases no. (2) and (3).
- (c) The iodine solution is changed in the case no. (4).

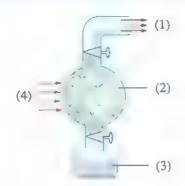
Explain the previous results in the light of your study to the photosynthesis process.

- What happens in case of: decreasing the temperature of a plant below its suitable value (according to the photosynthesis process)?
- Explain: the ability of plants to fix carbon dioxide (CO₂) in the dark, after being exposed to light.
- "The high-energy organic compounds are formed in the grana".

 How far this statement is correct? With explanation.

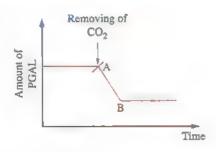


- 25 The opposite figure illustrates an experiment that shows the nature of dark reactions in an alga:
 - (a) Determine the mistake in the opposite experiment. Explain your answer.
 - (b) What happens in case of the absence of factor no. (4)?
 - (c) The scientist used the isotope of carbon not the oxygen. Explain this.

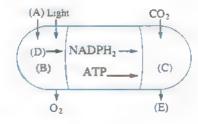


26 Some experiments were carried out on several farms of a type of unicellular green algea to illustrate the effect of CO₂ on the formation of phosphoglyceraldehyde (PGAL) compound. The opposite figure illustrates the results of these experiments:

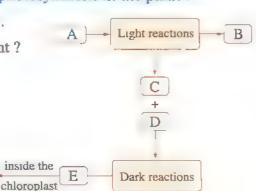
Explain the change that occurred at the part (AB), when preventing the alga from CO₂ gas.



- The opposite diagram illustrates a part of the plant where the photosynthesis process occurs:
 - (a) Where do the represented reactions in the opposite diagram occur?
 - (b) Determine the type of reaction that occurs in each of (B) and (C).



- (c) What is the limiting factor for the rate of reactions in each of (B) and (C)?
- (d) Deduce the names of (A), (D) and (E) compounds.
- **Explain:** there are multiple organic compounds that formed from the photosynthesis process products.
- 29 The following diagram illustrates some steps of photosynthesis in the plant :
 - (a) Deduce the names of substances from (A): (D).
 - (b) How the substance (E) is formed inside the plant?
 - (c) Suggest the site of presence of (F) inside the plant leaf. Explain your answer.





THREE

Heterotrophic Nutrition

Digestion

• The heterotrophic living organism (consumer) obtains its food in the form of ready organic materials which are usually large and complex molecules, therefore they can't diffuse through the cell membranes of living organism. So, the living organism must digest these molecules to benefit from them.



Digestion

Is the process of converting the large food molecules (polymers) into smaller ones (monomers) by means of hydrolysis, and this process is catalyzed by enzymes.

• The importance of digestion:

The breaking down of large and complex-structured food substances into simpler structured and smaller-sized molecules which are easily absorbed by the cells (by diffusion or active transport), where the cells use them as a source of energy or to build new tissues and continue the growth.

- Examples : Proteins Amino acids.
 - Carbohydrates Monosaccharides (such as : glucose).
 - Fats Fatty acids + Glycerol.



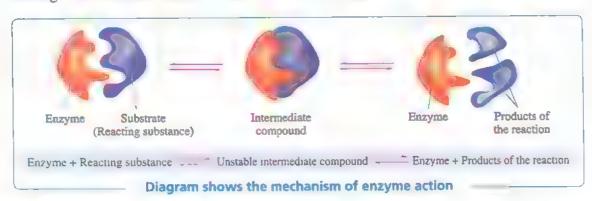
Enzyme

Is a protein substance which has the properties of catalysts, as it has the ability to activate a particular chemical reaction.



Mechanism of the enzyme action

- Each enzyme activates a particular chemical reaction (specific activation), and this reaction depends on:
 - The structure of reacting molecules (reactants or substrates).
 - The nature (shape) of enzyme.
- When the reaction is completed, the resulting molecules break away from the enzyme, leaving it in the same form as it was before the reaction.



Characteristics of enzymes

- 1 They are specific: as each enzyme can accelerate only one type of chemical reactions, depending on the structure of reactant molecule and nature (shape) of enzyme.
- Enzymes don't affect the products of reaction: as they work as catalysts which only accelerate the rate of reaction, until it reaches the equilibrium state.

Do you know ...?

 From the enzymes that have a reversible effect is carbonic anhydrase enzyme which catalyzes the following reaction in both directions, depending on the concentration of the reactants.

- 3 Some enzymes have a reversible effect: as the enzyme that catalyzes the decomposition of a complex molecule into two simpler ones, it also can recombine these two small molecules again to give rise to the same complex molecule once more.
- The degree of enzyme's activity depends on:
 - The temperature.

- The pH value of medium.
- Some enzymes are secreted in an inactive state and they are activated by specific substances:

pepsin enzyme is secreted by the stomach as an inactive pepsinogen which is changed into the active **pepsin** in the presence of hydrochloric acid (HCl) in the stomach.

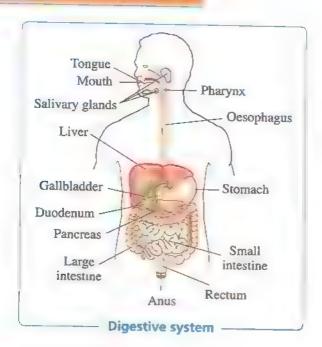
Pepsinogen HCl acid Pepsin (Inactive) (Active)

4	Test	yoursel
		/

The extent to which the body utilizes its food depends on the constancy of the body temperature at 37°C. Explain this.

Digestion in man

structure of the digestive system in man



- The digestive system in man consists of :
 - 1 Digestive (Alimentary) canal: consists of:
 - Mouth. Pharynx.
- Oesophagus.
- Stomach.

- Small intestine. -
 - Large intestine.
- Rectum.
- Anus.

- 2 Accessory (Associated) glands, which are:
 - Salivary glands.
- Liver.

- Pancreas.

Stages of digestion

Buccal digestion

Mouth

- The digestive canal starts with the mouth which contains:
 - 1 Teeth: that are differentiated into:
 - Incisors: lie at the front of jaw for cutting food.
 - Canines: follow the incisors to tear food.
 - Premolars and molars: follow the canines (at the back) for crushing and granding food.



- Organ of taste.
- Helps to manipulate the food and mix it with saliva to be chewed by the teeth.

3 Salivary glands:

- There are three pairs of salivary glands which open into the mouth cavity through ducts to secrete the saliva that contains:
 - Mucus that softens the food and facilitates its swallowing.
 - Amylase enzyme "Ptyalin" which works in weak alkaline medium of pH = 7.4 and catalyzes the hydrolysis of starch into disaccharide maltose (malt sugar).

Pharynx

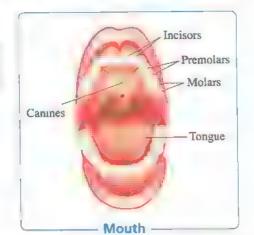
- It is a cavity at the back of mouth which leads to two tubes:
 - The first is oesophagus.
 - The second is trachea (which is considered a part of the respiratory system).

Do you know ...? -

Reflex action is an involuntary
fast response for a certain sensory
stimulus that is occurred without
the intervention of will or
consciousness.

Swallowing process

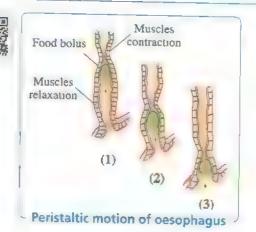
Is considered an organized reflex action, where during this process, the top of trachea and larynx are elevated together in front of the epiglottis to close over the glottis (the entrance to air passage). So, the food is pushed from the mouth to the oesophagus.



Oesophagus

- It follows the pharynx, where it passes through the neck and into the chest cavity, and extends parallel to the vertebral column with 25 cm long.
- It is lined with glands to secrete mucus.
- It transfers the food to the stomach by a series of rhythmical muscular contractions and relaxations called "Peristalsis" which continues along

the alimentary canal to churn and mix the food with the digestive juices.



Test yourself

Choose the correct answer:

- (1) The opposite graph illustrates the digestion of starch by the action of amylase enzyme. Which of the following statements is correct?
 - (a) The concentration of disaccharides at point (a) is more than that at point (b).
 - (b) The concentration of disaccharides at point (b) is more than that at point (a).
 - © The concentration of starch at point (a) is less than that at point (b).
 - d The concentration of starch at point (b) is equal to its concentration at point (a).

The concentration

of starch

Time

- (2) The swallowing process is considered a(an)
 - a voluntary process only.
 - (b) involuntary process only.
 - © voluntary, then involuntary process.
 - d involuntary, then voluntary process.
- "The digestion of rice, potatoes and bread by amylase enzyme doesn't antagonize with being specific in its work". Explain this statement.

(b)



The reason: it is preferred to chew the food well, before the swallowing process.
"The digestion process of food stops during the passage of food in the oesophagus".
They have this statement is correct? So in explanation,

Gastric digestion (Digestion in stomach)





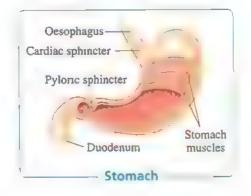
• It is a dilated muscular sac :

- It starts with a constricted circular muscle which is the cardiac sphincter that separates the stomach from the oesophagus.
- It ends with a muscular valve of circular smooth muscle which is the pyloric sphincter that separates the stomach from the small intestine.
- It secretes the gastric juice: is colourless acidic liquid which consists of:
 - 1 Water: with a percentage 90%
 - 2 Hydrochloric acid (HCl):

It creates an acidic medium (pH = 1.5 2.5) inside the stomach, which leads to:

- Stopping the action of ptyalin enzyme.
- Killing the harmful bacteria that may enter with the food.
- Pepsin enzyme: is secreted in an inactive form called "pepsinogen" and it is activated by the action of HCl acid, to digest the proteins.





Proteins digestion :

The active pepsin enzyme catalyzes the hydrolysis of protein by breaking certain peptide bonds in the long chains of protein, converting them into smaller fragments (chains) of polypeptides.

Notes

- Proteins are the only food substances which are affected by the gastric juice.
- The gastric juice doesn't affect the cells which line the stomach, this is due to:
 - The presence of pepsinogen in an inactive form which is activated only, after being secreted from the cells of stomach, and when it is mixed with HCl acid in the cavity of stomach.
 - The presence of heavy mucus secretions of the inner wall of stomach which protect it against the effect of digestive enzymes.

Test yourself

, ,,	est yourseit
	"Ptyalin enzyme works in the mouth only". How far this statement is correct? With explanation.
-	What happens in case of: the occurrence of a disturbance in the cardiac sphincter muscle?

3 Intestinal digestion

Small intestine

- It follows the stomach and consists of duodenum and ileum.
- It is about 8 meters long.
- It is about 3.5 cm in diameter at its beginning to reach 1.25 cm at its end.
- It folds over itself, the coils and loops of small intestine are connected together by the mesentery membrane.

- Universit

• The digestive juices inside the small intestine: a group of juices are secreted and work on food digestion, which are as follows:

Bile juice

- It is secreted from the liver on the food during its passage in the duodenum, and it is devoid of the digestive enzymes.
- It converts the fats into emulsified fats, (i.e. dividing the large masses of fats into small fat globules) to facilitate and accelerate the enzymatic action on fats that don't dissolve in water.

Note

The liver secretes the bile which passes through the bile duct to be stored in the gallbladder, until needed.

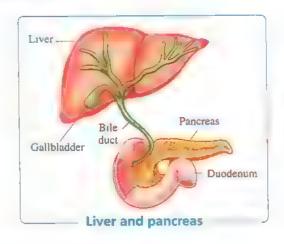
Pancreatic juice

- It is secreted from the pancreas on the food in the duodenum.
- Pancreatic juice contains:
 - O Sodium bicarbonate:

It neutralizes HCl acid and makes the medium alkaline (pH = 8).

② Pancreatic amylase enzyme:

It catalyzes the hydrolysis of glycogen and starch into disaccharide (maltose).



1 Trypsinogen enzyme:

It is inactive, but it changes into the active form which is "trypsin" in the duodenum by the action of enterokinase enzyme that is secreted by the inner wall of small intestine, where trypsin enzyme catalyzes the hydrolysis of protein into polypeptides.

① Lipase enzyme:

It catalyzes the hydrolysis of emulsified fats into fatty acids and glycerol.

Intestinal juice

• It is secreted by special cells in the wall of small intestine and contains a mixture of enzymes that complete the action of the previous enzymes and end the digestion of all food constituents, which are as follows:

Peptidases enzymes:

They are several types, where each one of them is specialized in breaking the peptide bonds that present between certain types of amino acids in the polypeptide chain to give various amino acids at the end.

- A group of enzymes which hydrolyze the disaccharides into monosaccharides, which are as follows:
 - Maltase enzyme: hydrolyzes maltose (malt sugar) into two molecules of glucose (grape sugar).

• Sucrase enzyme: hydrolyzes sucrose (cane sugar) into glucose and fructose (fruit sugar).

• Lactase enzyme: hydrolyzes lactose (milk sugar) into glucose and galactose.

3 Enterokinase enzyme:

It is not from the digestive enzymes, but it acts only as a co-enzyme to activate the trypsinogen enzyme.

4 Test yourself

(hoose the correct answer :

- (1) As a result of an injury in gallbladder of a person, it had been removed surgically, which of the following processes can be affected by this?
 - a) The removal of amino groups of proteins.
 - b The digestion of carbohydrates.
 - © The breaking down of peptide bonds of proteins.
 - d The digestion of fats.

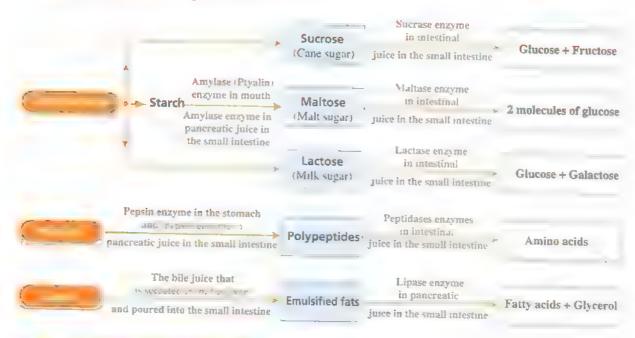


	(2) A person ate a type	e of food, while it was	not affected by the d	ligestive enzymes,
	until it reached the duodenum, what do you expect this type of food to be?			
	a Plant protein.	b Animal protein.	© Carbohydrate.	d Fat.
	(3) The enzyme that is	s secreted from the sn	nall intestine and com	pletes the action of
	another enzyme th	at is secreted from sto	omach is	
	(a) lipase.		b pancreatic amyla	ise.
	© trypsin.		d peptidase.	
	(4) All the following	enzymes produce asyr	mmetrical and simple	r molecules through
	their action, excep	ot		_
	a sucrase.	b lactase.	© lipase.	d amylase.
ì	pancreas se	ecretes trypsinogen en	zyme in an inactive f	orm, while it secretes
VC1 - 64	the amylase enzyme			
		EId++++ F ++H+H+	111,,,,,,,,,,,,,,,,,,,,,,,,,,,	
	AH W 484++ + 1 10++	*** * ***** (4****)::*******	****** *** 11 ******!! (***	
	* \$11 ***** *** ****1	*** * *** ******* * *	40++ F NN NHHATIAIA++ II +++ F	**** 1 * * * * * * * * * * * * * * * *

A summary for the digestive juices that are secreted on food in the alimentary canal:

The juice	The secretory organ	Site of action	Contents
Saliva :	Salivary glands.	Mouth	Mucus. Amylase (Ptyalin) enzyme.
Gastric juice :	Inner stomach wall.	Stomach cavity.	Water.HCl acid.Pepsinogen enzyme.
Bile :	Liver	Duodenum	Contains bile that is devoid of digestive enzymes.
Pancreatic juice :	Pancreas	Duodenum	 Sodium bicarbonate. Pancreatic amylase enzyme. Trypsinogen enzyme. Lipase enzyme.
Intestinal juice :	Specialized cells in the small intestine wall.	Small intestine.	 Peptidases enzymes. Maltase enzyme. Sucrase enzyme. Lactase enzyme. Enterokinase enzyme.

A summary for the stages of carbohydrates, proteins and lipids digestion along the alimentary canal:



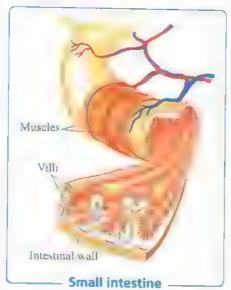
Absorption

Is the transfer of digested food substances to blood or lymph through the cells lining ileum (villi) in the small intestine.

Villi

- By studying the structure of the small intestine wall:
 - It was noticed that the inner epithelial lining of ileum is folded to form "villi".
 - The inner surface area of small intestine reaches about 10 m², i.e. about 5 times as much as the surface area of the human body, due to the presence of villi to increase the surface area of the small intestine that is subjected to the absorption of digested food.







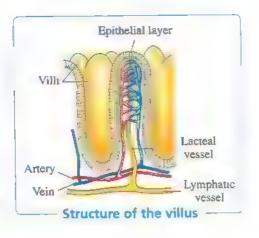
Structure of the villus:

- Epithelial layer:

Encloses a lacteal (lymphatic) vessel that is surrounded by a network of venous and arterial blood capillaries.

- Micro-villi:

They are very tiny projections from the epithelial layer of the villus that observed by the electron microscope, and they also increase the surface area of absorption.



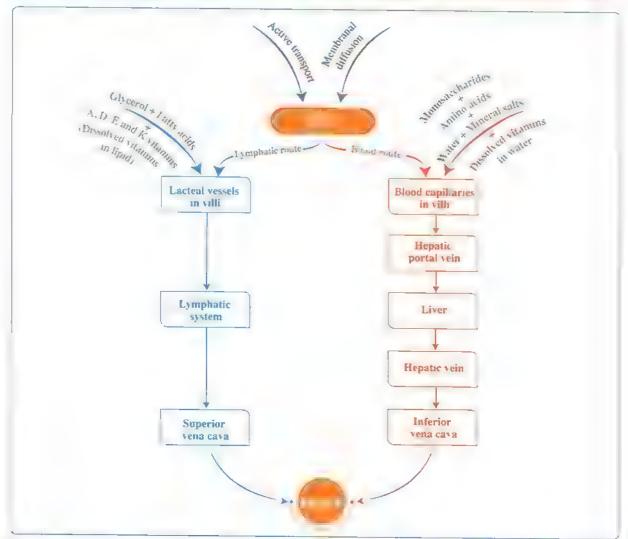
Mechanism of absorption of the digested food by the villi

- The products of digestion are transferred to the blood and lymph by the active transport and membranal diffusion.
- There are two routes in which the absorbed food substances pass in each villus, which are:
- 1 Blood route: starts with the blood capillaries inside each villus.
 - Into which water, mineral salts, monosaccharides, amino acids and water soluble vitamins pass.
 - These substances are poured into the hepatic portal vein, then to the liver and from it to the hepatic vein to be emptied into the inferior vena cava, then to the heart.

② Lymphatic route:

- Into which fatty acids, glycerol and fat soluble vitamins (A, D, E and K) pass.
- Some of these fatty acids and glycerol may recombine inside the epithelial cells of villi to form fats again.
- The epithelial cells absorb some of the finely emulsified fats that are not hydrolyzed by enzymes; directly by engulfment.
- All fats pass into the lacteal vessels inside the villi, then to the lymphatic system which carries them slowly and empties them into the superior vena cava, then to the heart.

The following diagram illustrates the routes of the absorbed food substances in villi:



Test yourself

Choose the correct answer:

- (1) The inner surface of the small intestine is considered
 - a) thin and rich in blood capillaries.
 - (b) thick and poor in blood capillaries.
 - © rich in villi and poor in blood capillaries.
 - d poor in villi and rich in blood capıllaries.
- (2) Which of the following food substances doesn't/don't reach the blood directly?
 - (a) Fatty acids.

(b) Amino acids.

© Water soluble vitamins.

d Glucose.



Metabolism

Metabolism:

Is the process by which the body utilizes the digested food substances that had been absorbed.

Metabolism includes two opposite processes, which are:

Anabolism

- A process by which the simple and small-sized food particles are changed into complex compounds that enter in the structure of body where:
- Monosaccharides are changed into starch that stored in the form of glycogen in the liver and muscles.
- The fatty acids and glycerol are changed into fats and stored mainly under the skin.
- The amino acids are changed into different types of proteins in the body.

2 Catabolism

• A process by which the absorbed food substances (especially glucose) are oxidized to produce the energy required for performing the vital activities of the body.

- The undigested food wastes pass to the large intestine.
- The lining of large intestine contains many convolutions to help in the absorption of water and some salts through it.
- Food wastes become semi-solid and have a bad odour inside the large intestine, due to the presence of some types of bacteria in it.
- The large intestine secretes mucus to facilitate the passage of food wastes to outside.



• Waste remains are expelled in the form of faeces through the anus, as a result of the strong muscular contractions of the rectum that accompanied by the relaxation of the two muscles of the anal sphincter which are situated on the both sides of anus.

6

Test yourself

Mucus has an important role along the alimentary canal, illustrate that in 4 different sites of the human digestive system.

QUESTIONS ON LESSON THREE

Heterotrophic Nutrition



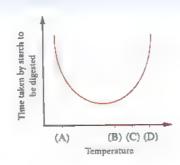
The questions signed by 🦸 measure the high levels of thinking.

Interactive Test

	Multiple	Choice Questions	
The digestion prod	ess of food aims to its	change into substances v	vhich can be
a swallowed.	(b) excreted.	© defecated.	d absorbed.
The following diag	gram shows a large food	I molecule changing into	
	——————————————————————————————————————	Process (X)	
What is the proces	s (X) ?		
a Absorption.	(b) Chewing.	© Digestion.	(d) Secretion.
From the opposite	figure :		
What happens to the		Enzyme (1) Enzyme	zyme (2) Enzyme (3)
of production of (I			
the enzyme no. (1)	is absent ? It will	# 4 # 4 m p q	
a stop.	b increase.	© decrease.	d not be affected
Which of the fo	llowing statements is co	orrect for all the catalyst	s?
a They are enzym	nes.	b They are protein	
. They speed up o	chemical reactions.	1 They work in liv	
Two enzyme-co	ntrolled reactions are sh	nown as follows:	_
		2yme (1) Proteins	
		Amino acids	
From these reaction		oe made about the enzyn	nes 7.
	been changed to enzym		nes ; · · · · · · · · · · · · · · · · · ·
	vs down the production		
_	ve reversible effect.	www.	
_	eak down large molecul	es only	



6 Four identical mixtures of starch and amylase were kept at different temperatures. The opposite graph shows the time taken for the starch to be completely digested at each temperature. At which temperature does the rate of the reaction increase?



(a) (A).

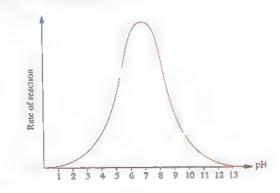
(b) (B).

© (C).

(D).

The opposite graph shows the effect of pH on a particular enzyme-controlled reaction:

At which pH value(s) is the enzyme inactive?



(a) At pH = 1 and pH = 13

b At pH = 3 and pH = 11

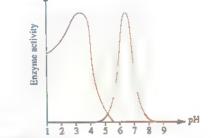
 \bigcirc At pH = 5 and pH = 9

enzymes the same?

 \bigcirc At pH = 7

The opposite graph shows the effect of pH on the activity of two enzymes.

At which pH value is the activity of both



. (1).

(c) (5).

(3).

(8).

9 On eating a piece of bread, which of the following enzymes will start its action first?

a Trypsin.

(b) Peptidase.

C Amylase.

d Lipase.

a glucose.

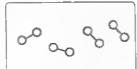
b maltose.

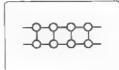
c sucrose.

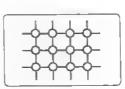
d lactose.

Which of the following figures illustrates a starch molecule, after being digested in the mouth?









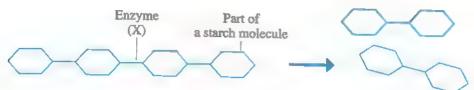
a

b

©

d

12 The following diagram shows the action of an enzyme:



What is the function of the enzyme (X)?

- (a) It breaks down the substrate into amino acids.
- (b) It changes the products into the substrate.

 It increases the rate of starch breaking down into glucose.
- d It increases the rate of starch breaking down into maltose.
- In which part of the human alimentary canal does the enzyme work efficiently, if the optimum pH for this enzyme = 7.5?
 - a Mouth.

b Small intestine.

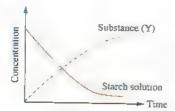
© Stomach.

- d Large intestine.
- The opposite graph illustrates the production of substance (Y), when the enzyme works on a starch solution. So, the substance (Y) is
 - a lactose.

b sucrose.

c glucose.

d maltose.



- When eating breakfast consists of eggs, honey and some toast, what do you expect to be digested first in the mouth?
 - Eggs.

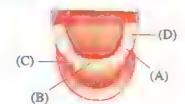
h Honey.

© Toast.

- d Honey and toast together.
- The opposite diagram shows the teeth of the lower jaw of a human. Which tooth is used for cutting food rather than grinding it?
 - (A).

© (C).

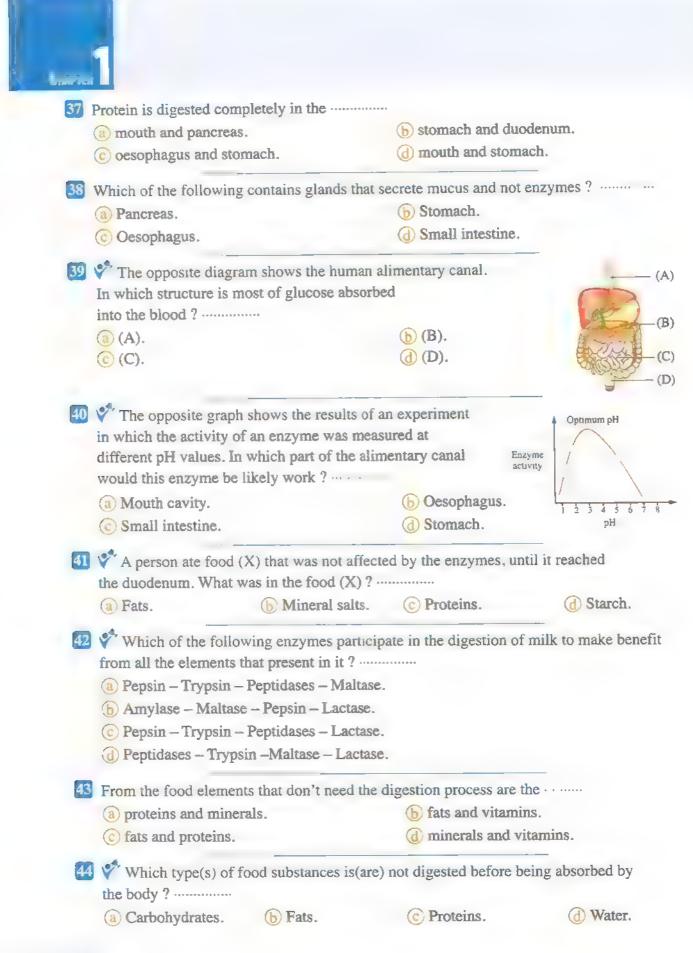
- **(B)**.
- (D).



- Why does the chewing of food speed up digestion process? Because the
 - a bacteria in food are killed.
 - b food is mixed with the protease.
 - © surface area of food is increased.
 - d taste of food is improved.



27	The digestion of each	ch of fats, proteins and o	carbohydrates togther is af	fected by
	a pancreas.	injury to theb stomach.	© large intestine.	d liver.
28	All the following er	nzymes digest the same	type of food substances, ex	van-t
	a maltase.	b lipase.	© sucrase.	d lactase.
29	8 01	zymes complete the act	ion of other enzymes or ju	ices by the breakin
	a lipase.	b enterokinase.	© peptidases.	d maltase.
30	After 8 minutes, the	protein changes from c sent in the test tube now	g protein in a test tube and loudy to transparent. Which is a simple sugar, dependent of Polypeptide chains.	th of the following
31	All the following en action, except	zymes produce simpler b maltase.	and symmetrical molecule	
32	amylase and lact	ase	ction of enzyme (b) amylase and sucrass (d) amylase and maltas	e
33	Which of the following Saliva. © Gastric juice.	ng doesn't contain diges	b Pancreatic juice.d Intestinal juice.	ates ?
34	All the following con a pepsin and trypsi HCl acid and enter	n.	action, except the bile juice and malta	tic amylase.
35	All the following enz	tymes digest the same ty	pe of carbohydrates, exce	pt ····································
36	because peptidase works in alkaline is secreted in an a works in the small	ective form, while pepsin Il intestine, while pepsin	works in acidic medium.	



45	Dietary protein passes through several	structures after leaving the	ne stomach.
	in which order does the dietary protein pas	ss through these structure	es ?
	a Duodenum Ileum Colon _	Rectum.	
	Duodenum Rectum		
	© Ileum Colon _	Rectum.	
	d Ileum Rectum		
46	The action of each of is requi	red to absorb A, D and K	vitamins
	a bile and amylase	bile and peptidas	
	© bile and pancreatic juice	d trypsin and enter	
47	In order for the vitamin (B) to reach the	e heart, it passes through	each of the following
	except the ·· ·· ·	,	each of the following.
	a hepatic portal vein.	b hepatic vein.	
	c inferior vena cava.	d superior vena car	Va.
48	The Salmonella bacteria infect human, whe	en eating contaminated for	and or water couries
	some symptoms as diarrhea. Which part of	the alimentary canal is n	nost
	affected?		2000
	Mouth. b Intestine.	© Oesophagus.	d Pharynx,
49	Due an infection in the gallbladder of a a surgical operation. Which of the following	man by a certain disease g processes will be affect	ed? The ····
49	Due an infection in the gallbladder of a a surgical operation. Which of the following removal of amino groups from proteins.	man by a certain disease g processes will be affect. digestion of carbo	, it is removed by ted? The
49	Due an infection in the gallbladder of a a surgical operation. Which of the following	man by a certain disease g processes will be affect	, it is removed by ted? The
50	Due an infection in the gallbladder of a a surgical operation. Which of the following removal of amino groups from proteins. absorption of amino acids. If the lacteal vessels are blocked inside anot enter in the blood circulation with a nor	man by a certain disease g processes will be affect. digestion of carbo digestion of fats. the villi, which of the following rate?	it is removed by the ded? The ohydrates.
50	Due an infection in the gallbladder of a a surgical operation. Which of the following removal of amino groups from proteins. absorption of amino acids. If the lacteal vessels are blocked inside	man by a certain disease g processes will be affect. digestion of carbo digestion of fats. the villi, which of the following rate?	it is removed by the ded? The ohydrates.
50	Due an infection in the gallbladder of a a surgical operation. Which of the following removal of amino groups from proteins. absorption of amino acids. If the lacteal vessels are blocked inside anot enter in the blood circulation with a nor	man by a certain disease g processes will be affect. digestion of carbo digestion of fats. the villi, which of the following rate? Fats.	, it is removed by ted? The bhydrates. lowing nutrients will d Fructose.
50	Due an infection in the gallbladder of a a surgical operation. Which of the following removal of amino groups from proteins. absorption of amino acids. If the lacteal vessels are blocked inside not enter in the blood circulation with a nor Amino acids. B Glucose. Which of the following substances its/their	man by a certain disease g processes will be affect. digestion of carbo digestion of fats. the villi, which of the following rate? Fats.	, it is removed by ted? The bhydrates. lowing nutrients will d Fructose.
51	Due an infection in the gallbladder of a a surgical operation. Which of the following removal of amino groups from proteins. absorption of amino acids. If the lacteal vessels are blocked inside anot enter in the blood circulation with a nor a Amino acids. B Glucose. Which of the following substances its/their digestion in the digestive system?	man by a certain disease g processes will be affect. digestion of carbo digestion of fats. the villi, which of the folumal rate? Fats. absorption route differs Fats.	d Sugar.
51	Due an infection in the gallbladder of a a surgical operation. Which of the following removal of amino groups from proteins. absorption of amino acids. If the lacteal vessels are blocked inside not enter in the blood circulation with a nor a Amino acids. B Glucose. Which of the following substances its/their digestion in the digestive system? Proteins. B Starch. The absorption process of the digested food process, because it is the	man by a certain disease g processes will be affect. digestion of carbo digestion of fats. the villi, which of the foltomal rate? Fats. Fats. substances by villi is call	d Fructose. Glowing nutrients will Glowing structose. Glowing structose. Glowing structose. Glowing structose. Glowing structose.
51	Due an infection in the gallbladder of a a surgical operation. Which of the following removal of amino groups from proteins. absorption of amino acids. If the lacteal vessels are blocked inside not enter in the blood circulation with a nor a Amino acids. B Glucose. Which of the following substances its/their digestion in the digestive system? Proteins. B Starch. The absorption process of the digested food process, because it is the conversion of the large food molecules in the surgicular to the following substances.	man by a certain disease g processes will be affect. digestion of carbo digestion of fats. the villi, which of the foltomal rate? Fats. Fats. Substances by villi is called the small-sized molecule.	d Fructose. Glowing nutrients will Glowing structose. Glowing structose. Glowing structose. Glowing structose. Glowing structose.
51	Due an infection in the gallbladder of a a surgical operation. Which of the following removal of amino groups from proteins. absorption of amino acids. If the lacteal vessels are blocked inside not enter in the blood circulation with a nor a Amino acids. B Glucose. Which of the following substances its/their digestion in the digestive system? Proteins. B Starch. The absorption process of the digested food process, because it is the	man by a certain disease g processes will be affect. digestion of carbo digestion of fats. the villi, which of the foltomal rate? Fats. Fats. Substances by villi is called the small-sized molecule enzymes.	d Sugar.
51	Due an infection in the gallbladder of a a surgical operation. Which of the following removal of amino groups from proteins. absorption of amino acids. If the lacteal vessels are blocked inside not enter in the blood circulation with a nor a Amino acids. Begin Glucose. Which of the following substances its/their digestion in the digestive system? Proteins. Begin Glucose. The absorption process of the digested food process, because it is the conversion of the large food molecules in hydrolysis process that depends on the entering transfer from the medium with the lower	man by a certain disease g processes will be affect. digestion of carbo digestion of fats. the villi, which of the foltomal rate? Fats. Fats. Substances by villi is called the small-sized molecule enzymes.	d Sugar.



mer I a	L				
53	The small intestine of cows is similar in general structure and function to				
	the small intestine of	humans. A disease in o	ows reduces the number	of villi in their small	
intestine, therefore they lose weight and become weak. What explains this?					
	. The production of	less amylase.	The occurrence of	of less peristalsis.	
	Slower absorption	of nutrients.	Slower digestion	of proteins.	
The activity of lipase is measured in four parts of the gut. Which part has the most activity?					
	a Colon.	b Duodenum.	© Oesophagus.	d Stomach.	
55	The process by which	the absorbed food be	comes a part of the body	is called · · · · ·	
	anabolism.	b catabolism.	© digestion.	d absorption.	
56 All the following may cause the presence of a high percentage of fats in the waste the digestive system, except a disturbance in					
	a the action of pano		(b) the action of lipa		
	c the bile juice secr	etion.	d HCl acid secretic	on.	
57	All the following are	considered the results	for the non-occurrence	of digestion process of	
	a food bolus, except				
	. the impermeabili	ty for its simple molec	ules through the cell me	mbranes of	
	the alimentary ca	nal.			
	the non-occurren-	ce of absorption proce	ss in the small intestine.		
	c its presence in the	e form of wastes in the	large intestine.		
	d that the body ben	efits from it as a source	e of energy.		
	Miscellaneous Questions				
1	What hannone in a	es of the absence of	enzymes from the diges	tive system ?	

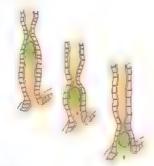
the enzyme is present?

4 Give reason: food passes easily in the digestive canal.

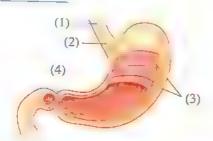
Explain: some enzymes work in two opposite directions.

3 What happens in case of: increasing the temperature of the medium in which

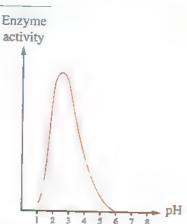
- What happens in case of: placing a piece of bread in the mouth and chewing it for three minutes?
- The opposite figure represents a part of the human digestive system:
 - (a) Where does this movement take place in the digestive canal? And what is its name?
 - (b) Illustrate the mechanism of this movement.
 - (c) What is the function of this movement in the process of food digestion?



- What happens in case of: removal of epiglottis from the pharynx?
- 8 Give reason: human doesn't suffer from ulcers in the oesophagus, when eating dry foods.
- 9 What happens if: a person took a high dosage of antacid drug?
- 10 From the opposite figure :
 - (a) How does the structure no. (3) participate in the digestion process?
 - (b) What is the functional sutability of the structure no. (1)?



- What happens if: the pepsin enzyme is formed in an active form inside the stomach cells?
- 12 The opposite graph illustrates the effect of pH on the rate of a digestive enzyme activity:
 - (a) Determine the name and site of action of this enzyme.
 - (b) At which pH value does the rate of activity of this enzyme increase?
 - (c) What is the substrate of this enzyme? And what is the product of this reaction?

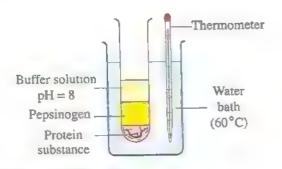


Give reason: starch is not digested inside the stomach, despite of mixing the food with ptyalin enzyme.

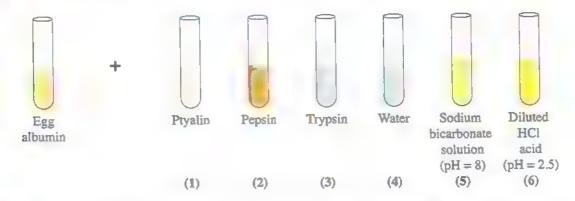


14 🐕 In the opposite figure :

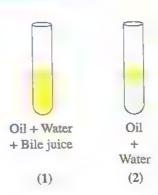
Correct the mistakes in this figure to make the enzyme work with maximum efficiency and digest the reactant (protein substance that presents in the tube) "without drawing".



- Give reason: the occurrence of stomach ulcer in some cases.
- Explain: the activity of liver improves the efficiency of digestion process.
- Give reason: bile juice is not a digestive juice.
- Form from the following test tubes, two different solutions that can be used to digest the egg albumin, explain your answer.



- Give reason: pepsin enzyme digests protein in the stomach, while its action stops in the small intestine.
- 20 In the opposite figure, the pH value in the two test tubes is adjusted at 8:
 - (a) After adding the lipase enzyme to each one of the two test tubes, the mixture shape is changed in one of them before the other. Determine the number of this test tube, and explain your answer.
 - (b) Determine in which test tube the pH value will change after a period of time from putting the enzyme, in order to make the medium weak alkaline (pH = 7.2). Explain your answer.

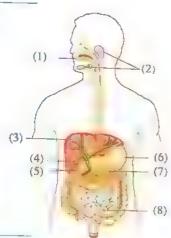


- 21 Give reason: enterokinase enzyme plays an indirect role in the proteins digestion.
- A sample of the juice that presents inside the pancreatic duct was taken, what is the digestive effect of this sample, if drops of this sample are put on each of the following separately, explain your answer:
 - (a) Proteins.

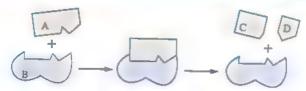
(b) Lipids.

- (c) Starch.
- 23 * "Eating fast food stimulate the activity of peptidases enzymes to digest them".

 How far this statement is correct? With explanation.
- "The small intestine contains a mixture of food substances, such as polypeptides and several enzymes, such as trypsin".
 Deduce the reason for no effect of trypsin on the polypeptides, although it digests the proteins.
- "The degree of hydrogen ion concentration (pH) plays an important role in the stages of food digestion".
 - (a) Illustrate the role of pH in mouth, stomach and duodenum.
 - (b) Mention a food substance that is digested at two different values of pH
- The opposite figure illustrates a diagram for the digestive system structure:
 - (a) Write the number and name of the organ that:
 - 1. Secretes the protein digestive enzymes.
 - 2. Doesn't secrete any digestive enzymes.
 - Secretes amylase enzyme.
 - 4. The digestion of carbohydrates occurred inside it.
 - (b) What is the function of the liquid that is produced by the part no. (7) and secreted in the part no. (5)?



27 The following diagram illustrates the action of a digestive enzyme:



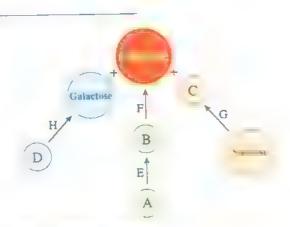
- (a) If (D) is a fructose molecule. What do (A), (B) and (C) represent?
- (b) Suggest one factor that affects the activity of this enzyme.



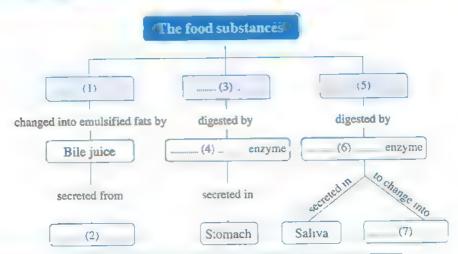
- The alimentary canal contains enzyme (X) that hydrolyzes the molecule (A) into two similar molecules of monosaccharides":
 - (a) What is the name of each of the enzyme (X) and the molecule (A)?
 - (b) In which part in the alimentary canal is enzyme (X) secreted? And in which part is the molecule (A) formed?

29 In the opposite diagram:

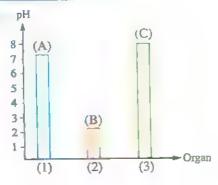
- (a) What do the letters that are illustrated in this diagram represent?
- (b) Deduce what happens if (F) is replaced by (E), explain your answer.
- (c) Determine the sources of secretion of (E), (F), (G) and (H) in the digestive system.



30 The following diagram shows a summary for the digestion process of food substances, complete the diagram using suitable words:



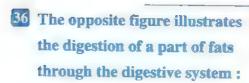
- The opposite graph illustrates the activity of some enzymes in several parts of the digestive system:
 - (a) If you know that the enzyme (C) has an indirect role in the digestion process, mention the name of this enzyme.
 - (b) What is the source of the enzyme that is activated by the enzyme (C)?



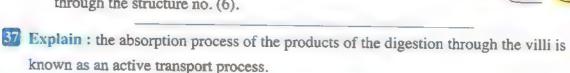
- (c) Deduce the name of the compound that activates the enzyme (B).
- (d) If you know that the enzyme (A) whose activity stops in the organ no. (2). What is the name of this enzyme?
- Explain: the presence of carbohydrates in the form of monosaccharides in blood.
- "The activity of enzymes depends on the type of food that the human eats".

 How far this statement is correct? With explanation.
- 34 Give reason: the presence of engulfing cells in the epithelial layer of villi.
- 35 The opposite figure represents the structure of a villus:
 - (a) Mention the names of structures which transport the amino acids and fatty acids.
 - (b) Which of the two structures no. (4) or (5) contains a higher percentage of glucose? Explain your answer.
 - (c) Mention the name of structure which pours its contents in the superior vena cava.
 - (d) Illustrate the function of structure no. (3).
 - (e) Compare between: the structure no. (1) and structure no. (5), "according to: the absorbed substances and their path".

Fats

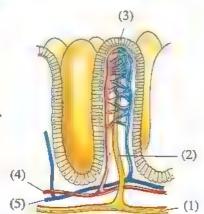


- (a) Write the labels from no.(1): (6).
- (b) Mention the path of the absorbed substances through the structure no. (6).



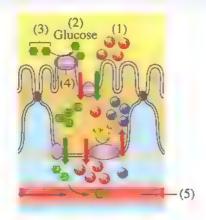
The inferior vena cava carries substances that are digested completely.

How far this statement is correct? With explanation.





- 39 Study the opposite figure that illustrates one of the important processes, occurring in the human body, then answer the following:
 - (a) Mention the names of each of (3), (4) and (5).
 - (b) How are (1) and (2) absorbed?
 - (c) Deduce the site of occurrence of this process.



- "The epithelial layer cells of the villi have a role in the digestion process".

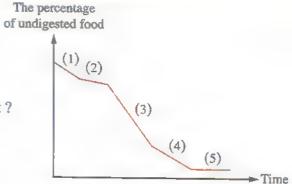
 How far this statement is correct? With explanation.
- 41 Give reason: (A), (D), (E) and (K) vitamins pass through the lymphatic route, while vitamin (B) passes through the blood route.
- 42 "A man ate a piece of meat".
 - (a) How does his digestive system digest this meat?
 - (b) What is the route that the products of digestion process passed through to reach the liver?
- 43 "A meal consists of bean, oil and bread".
 - (a) Determine the first place in which the digestion of each part of such meal begins and the juice which digests each part.
 - (b) What is the final form of digestion of these components?
 - (c) Which route is taken by the glucose sugar to reach the heart?
- The digested food transfers totally from the villi of the small intestine to the heart through the inferior vena cava".

How far this statement is correct? With explanation.

- Explain: theoritically, human can live without stomach, but he can't live without small intestine.
- What happens in case of: the removal of ileum from the body of a mammalian animal experimentally?
- "The absorption process occurs in the small intestine only".

 How far this statement is correct? With explanation.

- What happens if: the metabolism of the absorbed food in the liver is not occurred?
- The opposite graph shows
 the percentage of undigested food
 of a meal along the alimentary canal,
 starting from the mouth:



- (a) What do the parts from (1): (5) represent?
- (b) Explain: the decline of the curve at (2) and its constancy at (5), although the digestive enzymes are not secreted in these two parts.
- (c) What is the substance that can be digested at (1) and (4)?
- (d) Why doesn't this curve reach the zero point vertically?
- (e) In which part each of the following occurs:
 - 1. Absorption of the digested food.
 - 2. Absorption of water from the wastes of undigested food.
 - 3. The stopping of the digestion process.
- What happens in case of: the absence of convolutions from the lining of large intestine?
- 51 Explain: hydrochloric acid plays an important role in the digestion process in stomach.



Nutrition and Digestion in Living Organisms



Choose the correct answer (1:21):

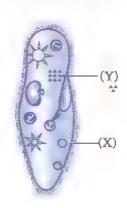
- If we supposed that the plant (X) obtains its food in the form of glucose, vitamin (B), water and salts. So, this means that the plant is
 - autotrophic and contains simple chlorophyll.
 - b autotrophic and contains chlorophyll (A) only.
 - © autotrophic and contains chlorophyll (B) only.
 - d heterotrophic and doesn't contain chlorophyll (A) or (B).
- The following diagram represents a vital process that occurs inside the human body, it is possible that

Protein +
$$H_2O$$
 (x) (Y) (Y) (Y)

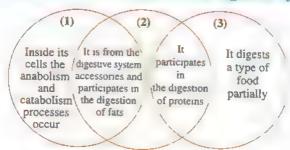
- (a) (X) is the peptidase enzyme and (Y) is polypeptide.
- (Y) is the peptidase enzyme and (Y) is amino acid.
 - © (X) is the trypsin enzyme and (Y) is amino acid.
 - (X) is the pepsin enzyme and (Y) is polypeptide.
- The opposite figure illustrates a unicellular animal that lives in the swamp and pond water, the arrow shows the transfer of molecules (Y) through the structure (X) by phenomenon.



- **b** active transport
- © imbibition
- d osmosis

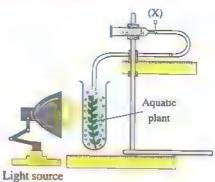


The following figure represents three organs of the digestive system in human:



- The organ(s) that participate(s) in the dividing process of food without changing in the chemical structure is(are)
 - (a) (1) & (2).
- (b) (2) only.
- © (3) only.
- **(1)** & (3).
- The organ(s) that secrets(s) enzymes to digest all the types of food is(are)
 - **a** (1) & (2).
- (b) (2) only.
- © (3) only.
- **(1) (2)** & **(3)**.
- The organ(s) that can be removed without affecting the human life is(are)
 - (1) & (2).
- (b) (2) only.
- (c) (3) only.
- (1) (2) & (3).

The following figure illustrates an experiment to study a vital process in the plant, examine it, then answer:



- The gas(es) that is/are collected in the structure (X) is/are
 - a oxygen.

(b) nitrogen.

c carbon dioxide.

- d oxygen and carbon dioxide.
- - (a) temperature to the optimal degree.
 - (b) concentration of CO, in water.
 - © distance between the light source and the plant.
 - d light intensity.



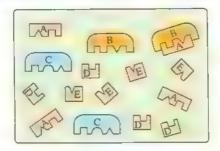
The opposite figure illustrates the role of an enzyme in the digestion process, which of the opposite structures represent the products of this process?



(b) C and B

© E and A

(d) D and E



Which one of the choices in the following table, illustrates the correct number of chloroplasts in three different cells in a green plant leaf?

	Epidermal cell	Palisade tissue cell	Spongy tissue cell
L.C	0	6	17
7	0	17	6
©	6	17	0
d	17	0	6

- In an experiment similar to that of Melvin Calvin, CO₂ with O¹⁸ isotope and H₂O with O¹⁶ isotope were used, what is the product that resulted first?
 - PGAL containing O¹⁶
- (b) Glucose containing O¹⁶
- © Glucose containing O18
- (d) PGAL containing O¹⁸

(12) Study the following figure, then determine:



Which of the following enzymes affects this compound to start its absorption?

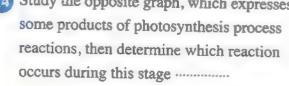
a Amylase.

(b) Pepsin.

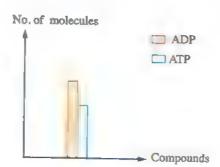
© Trypsin.

d Peptidase.

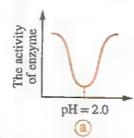
- (13) What is the result of sugar deficiency in the sap vacuoles of Nitella alga which live in a swamp poor in chlorine, although the plant need it?
 - Chlorine absorption increases.
- Water absorption decreases.
- Active transport process decreases.
- Strach production rate increases.
- Study the opposite graph, which expresses some products of photosynthesis process reactions, then determine which reaction

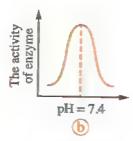


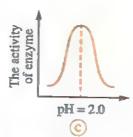
- (a) H₂O splitting.
- b NADP reduction.
- © Photosyntheic phosphorylation.
- d CO, reduction.

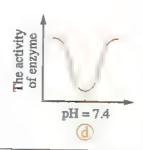


- - If you know that pepsin becomes active in small range of high concentrations of H ions, which of the following graphs expresses the highest rate of pepsin activity and (pH) value ?









- - Which of the following plants are characterized by high osmotic pressures?
 - Normal plants and pure water environment plants.
 - Normal and desert plants.
 - © Desert plants and pure water environment plants.
 - Obsert plants and salty water environment plants.



- 17 What are the compounds that their formation inside the chloroplast is affected by "N" deficiency?
 - a Enzymes.

(b) PGAL.

© Glucose.

d Starch.

- 18) What are the food substances that are re-built and work as an insulator which protects the body from cold weather? -----
 - (a) Vegetables and fruits.

(b) Meat and eggs.

© Meat and vegetables.

d Peanuts and sesame.

19 Which of the following shows the changes that occur in the size of corn plant cells and their pressure of fullness when the sugar concentration increases inside the cells?

	Cells' size	H ₂ O fullness pressure
a	Increases	Increases
Ъ	Decreases	Decreases
©	Decreases	Increases
d	Increases	Decreases

- 20 Which of the following pathways describes the flow of electrons during photosynthesis process ?
 - NADPH₂-H₂O-Dark reactions. O₂-ADP-Dark reactions.

H₂O-Dark reactions-NADPH₂ J H₂O-NADPH₂-Dark reactions.

- 21 Fungal infection causes defeciency of the chlorophyll formation in the plant cells, which of the following happens as a result for this defeciency?
 - (a) The non-formation of the co-enzymes.
 - (b) The non-formation of ATP in light reactions.
 - © No entrance of CO₂ to the stroma.
 - Defeciency in the amount of glucose formed from photosynthesis.

Answer the following questions (22:27):

ij	Although the purple sulphur bacteria are autotrophic, they differ from the green particle in the photosynthesis process. Explain this.
V n	What happens if: the number of chloroplasts in the palisade tissue is equal to the umber in the spongy tissue?
h ig In	The opposite figure illustrates Euglena which is a unicellular living organism that characterized by the presence of a flagellum for movement, eyespot for eight sensitivity and also chloroplasts. The light of your study: Eyespot Nucleus The light of your study: Eyespot Nucleus Chloroplasts. Chloroplasts.



a '	ne opposite figure represents T.S. in a plant leaf, study it, en answer: The cells of structure (X) are barrel-shaped, explain this.	(Y) (2) (2)	
(lb	b) What is the difference between: streethe tissue (Y)?	ucture no. (1) and struc	cture no. (2) in
th	the opposite figure represents a part on the digestive canal, examine it, then an a) Deduce the functional suitability of the	swer:	_ (2)



Lesson 1: Transport in Plant.

Lesson 2: Human Transport System (Circulatory System).

Lesson 3: Continue: Human Transport System (Blood Circulation

and Lymphatic System).

Model Exam on chapter 2

O jectives of the chapter

By the end of this chapter, the student should be able to:

- · Identify the concept of transport in higher plants.
- · Deduce the mechanism of transport from the root to the leaf.
- Discover the factors that are responsible for the ascent of sap.
 Recognize the transport of manufactured food from the leaf to other parts of the plant.
- · Explain the role of sieve tubes in transport.
- Identify the structure of transport system in man.
 Identify the circulatory system.
 Identify the contents and functions of blood.
 Identify the heartbeat and blood pressure.
- · Understand the blood circulation.
- · Understand the mechanism of blood clot formation.
- · Identify the components of lymphatic system.



 It is clear from our previous studies for the nutrition and digestion in living organisms that each living organism needs various substances that transport (move) inside its body by different means.

Transport in lower (primitive) plants

• Lower (Primitive) plants (like algae) don't need a specialized transport tissues, as the raw materials (carbon dioxide, water and mineral salts) move with the products of photosynthesis from one cell to another by diffusion and active transport.

Transport in higher plants

- Gases (oxygen and carbon dioxide) move by diffusion.
- Water, mineral salts and soluble products of photosynthesis are transported through a specialized vascular tissues which are:
 - Xylem tissues (vessels and tracheids):

They translocate water and mineral salts that are absorbed from the soil through the root across its different tissues, till they reach the xylem vessels of root, then to the xylem of stem, then to the leaves where the photosynthesis process takes place.

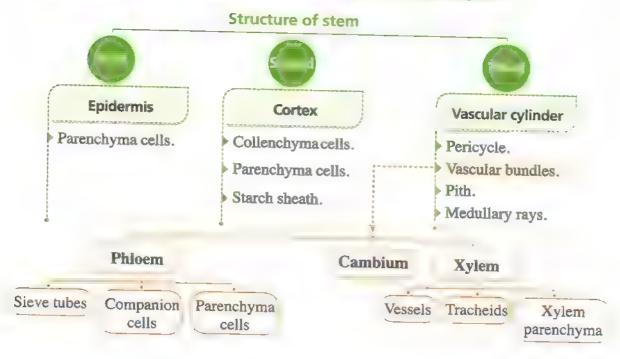
② Phloem tissues (sieve tubes):

They translocate the high-energy organic food substances (carbohydrates, fats and proteins) from the sites of their production (leaves) to the sites of their storage and consumption in the different tissues of plant (roots, stems, fruits and seeds) through the sieve tubes in the phloem of leaf, stem and root.

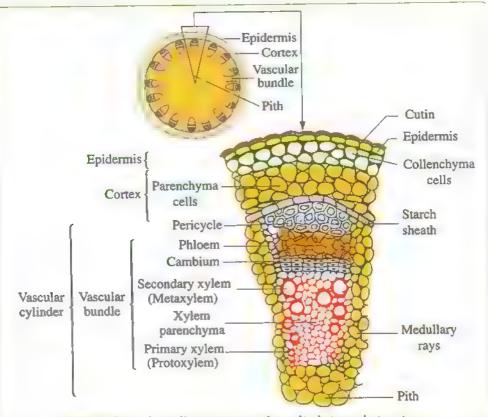
• We should now study the internal structure of stem to help us to understand the role of stem in the process of transportation.

Olivinium of the plant them

• On examining a cross-section in a dicot plant stem under the microscope, it was found that it consists of a group of tissues, as shown in the following diagram:







Detailed T.S. in a dicot stem to show its internal structure and the vascular bundle as a transport system

Epidermis

• It consists of: one row of adjacent and barrel-shaped parenchyma cells. The outer walls are covered by a cuticle (layer of cutin).

Fertinal

Cortex

- It consists of :
 - ① Collenchyma cells:
 - Description: they are several rows of cells which have thickened corners by the deposition of cellulose and they may contain chloroplasts.
 - Functions: Act as a mechanical tissue for the support of stem.
 - Take part in the photosynthesis process (in case of the presence of chloroplasts).
 - Parenchyma cells :
 - Description: they are several rows of parenchyma cells with plenty of intercellular spaces.
 - Function: aeration.
 - (1) Starch sheath:
 - Description: the innermost row of cells of the cortex.
 - Function: storage and keeping of the starch granules.

Third

Vascular cylinder

- It occupies a large space of the stem and consists of the following tissues:
 - Pericycle.
- Vascular bundles.
- Pith.
- Medullary rays.

Pericycle

- Description : A group of parenchyma cells alternates with groups of fibrous cells.
 - Each group of fibers faces a vascular bundle from the outside.
- Function: makes the stem strong and elastic.

2 Vascular bundles

 They are arranged in a cylinder, where each bundle is triangular in shape with its base directed outwards and it consists of:

A Phloem

- It represents the outer tissue (part) of vascular bundle.
- Function: transporting the organic food substances from the leaves to all the plant parts.
- Structure: it consists of sieve tubes, companion cells and phloem parenchyma cells.



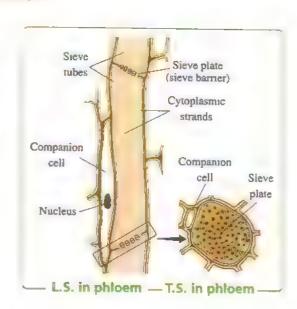
- They are elongated cells which contain cytoplasmic strands without a nucleus.
- They are separated from each other by cross-walls that are perforated by tiny pores through which the cytoplasmic strands extend from one tube to another, these perforated cross-walls are called the "sieve plates (barriers)".

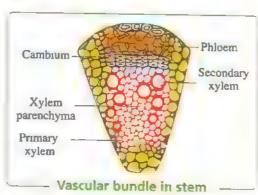
Companion cells

- They are living cells with a nucleus, where each cell of them is accompanied by a sieve tube.
- They contain a large number of ribosomes and mitochondria which enable them to organize the vital processes of sieve tubes.

B Cambium

- Description: it consists of one row or more of meristematic cells that found between the phloem and xylem.
- Function: its cells divide to give rise externally to a secondary phloem and internally to a secondary xylem.







Xylem

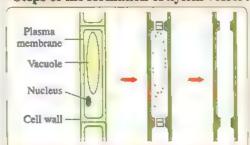
- It represents the internal tissue (part) of vascular bundle.
- Functions: Translocating water and solutes from the root to stem, then to the leaves.
 - Supporting the stem.
- Structure: it consists of vessels, tracherds and xylem parenchyma.

Vessels

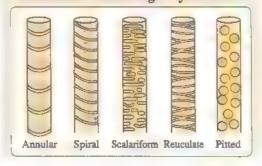
- Structure: they consist of a series of elongated cylindrical cells that are joined end to end.
- Steps of their formation:
 - At first, the transverse walls of the cylindrical cells have been completely dissolved, so the cells become joined with ends (one tube).
 - The cellulose wall of cells is thickened by lignin substance which is impermeable to water and solutes.
 - The protoplasmic contents of cells died, leaving a hollow vessel (tube).
- Numerous pits are scattered all over the vessel wall, where the primary wall is left without thickening to allow the passage of water from inside the vessel to its outside.

Do you know ...? -

Steps of the formation of xylem vessel :



The forms of thickening in xylem vessels :



- Strands of lignin are laid down on the inner lining of vessel with various forms, such as annular and spiral to support the vessel and prevent the collapse (curve) of its wall inwards.

Tracheids

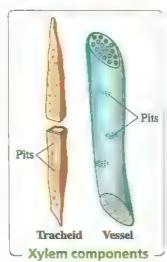
They are more or less similar to the vessels, whereas they appear in T.S. different in being:

- A pentagonal or hexagonal form.
- A pointed (tapered), as the two ends are not opened.

They are similar to the vessels in being pitted.

Xylem parenchyma

Description: rows of parenchyma cells that present between the xylem vessels.



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Xylem in the vascular bundles of stem is connected with the xylem of root and leaves. Also, the phloem of stem is connected with that of root and leaves. Therefore, there is a network of vessels that spreads all over the plant parts.

Pith

- Description: parenchyma cells occupying the centre of stem.
- Function : storage.

Medullary rays

- Description: parenchyma cells extending between the vascular bundles.
- Function: join the cortex with the pith.

Test yourself

Choose the correct answer:

- (1) All the following are from the functions of stem's cortex, except the
 - (a) supporting.

the plant?.....

- (b) transport.
- © photosynthesis. (d) storage.
- (2) Which of the following structures doesn't have a supporting function in
 - (a) Parenchyma cells. (b) Collenchyma cells. (c) Xylem tissue.
- Explain: although the sieve tubes are devoid of nuclei, they are able to transport the food compounds.
- There are several regions in the plant in which the starch granules are stored, discuss.



- This process includes two different processes which are:
 - The transport of water and salts from the root to the leaf.
 - The transport of manufactured food from the leaf to all the plant parts.

Mechanism of water and salts transport from the root to the leaf

• Xylem is responsible for the translocation of water and salts from the root to the leaves by forces acting on the ascent of this sap.



Forces acting on the ascent of sap in the plant

- * From the most important theories that explain the ascent of water in plant are:
 - Root pressure theory.
- Imbibition theory.
- Capillarity theory.
- Cohesion Adhesion Transpiration pull theory.

1 Root pressure theory

- If the plant stem is cut very near (close) to the soil level, we can see the exudation (exit) of water from the stump (cut stem). This phenomenon is known as exudation which occurs, due to the force or pressure in the root, as a result of its absorption for water by osmosis phenomenon, and this is called by the "root pressure".
- The root pressure causes water to be forced vertically upward through the xylem vessels, but it stops after a short distance, as at this level, the opposing pressure of water column in xylem vessels has become equal to the root pressure.



Exudation phenomenon

- Experiments had proved that the root pressure theory couldn't explain the ascent of water to high-levels in tall trees, because:
 - Root pressure doesn't exceed 2 atm in the best conditions.
 - Gymnosperm plants (Conifers), such as Pinus have no root pressure.
 - The root pressure is affected quickly by the external factors.

2 Imbibition theory

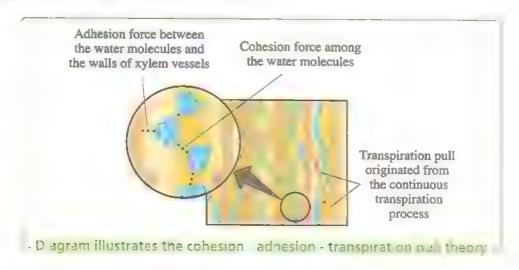
- The walls of xylem vessels consist of cellulose and lignin that have a colloidal nature which has the abitity to imbibe water.
- This phenomenon explains the transport of water along the cell walls, until it reaches the walls of xylem vessels and tracheids of the root, and from it to the rest of plant parts.
- Experiments had proved that the imbibition phenomenon has a very limited effect on the ascent of sap, because the sap ascends through the cavities of xylem vessels and not along their walls only.

3 Capillarity theory

- Water rises by the capillarity phenomenon in the capillary tubes, such as the xylem vessels whose diameter ranges from 0.2 mm to 0.5 mm.
- Capillarity phenomenon is considered a weak secondary force for the ascent of sap, as the finest capillary tube doesn't allow the rise of water more than a height of 150 cm.

4 Cohesion - Adhesion - Transpiration pull theory

• The two scientists H.H. Dixon and J. July in 1895 established the principles of the cohesion - adhesion - transpiration pull theory, where they proved that "water is pulled by the leaf, due to the consumption of water in the metabolic processes, transpiration and evaporation in leaves".



• The theory is summarized in that the water column rises in the xylem vessels depending upon three forces, as shown in the following table:

The force	The evidence on the presence of this force	The conditions needed for water to have a high pulling force in the xylem vessels	
Cohesion force between the molecules of water inside the xylem vessels and tracheids.	The presence of a continuous column of water inside the vessels.	• The tubes must be free of any gases or air bubbles to avoid the break and descend of the water column.	
Adhesion force between the water molecules and the walls of xylem vessels.	Water column is held continuously against the effect of gravity.	• Walls of the tubes must possess an adhesion force to	
Transpiration pull which originated from the continuous transpiration in the leaves.	The presence of continuous attraction of the water column upward.	attract water (colloidal natu Tubes must be capillary.	

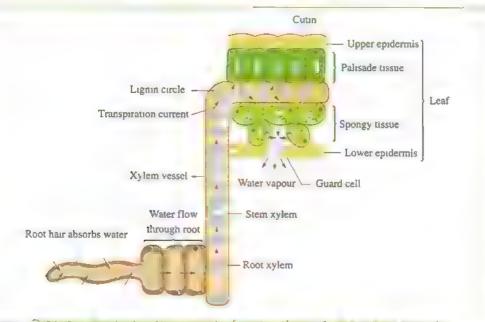
• The plant physiologists had proved that these forces are the main forces that work on pulling water in the stem for a very high distances which reach about 100 m.

___2

When some seedlings are transplanted from a nursery to an open soil, they fail to grow, if they exposed to the Sun for a long time without planting, because of the entry of gases or formation of air bubbles inside the conducting tubes (xylem vessels and tracheids), causing the break of cohesion of water column molecules inside these tubes, preventing the arrival of sap and finally the seedlings wilt and die.

Path of sap ascent from the root to the leaves





- Diagram illustrates the ascent of water through the kylem vessels
- Leaves lose the water vapour that presents in the air chambers in the transpiration process through the stomata which lessens the water concentration (humidity) in the air chamber above the stomata in the leaf.
- The air chambers will pull water from the cells of mesophyll tissue surrounding the stomata chambers to compensate their loss of water, as a result of the increase of evaporation process.
- The water content of these cells will decrease and their sap concentration will increase.
- The mesophyll tissue's cells will attract water from the surrounding cells, till reaching the xylem vessels in the venules and vens, then finally from the midrib of the leaf.
- Water presents in the xylem vessels will be subjected to a great pulling force, therefore water will ascend through the xylem vessels and tracheids of both stem and root, as they are connected to each other.

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The transpiration pull that is originated from the transpiration in the leaf will not only pull up water from the vascular cylinder of root, but it will also help in the lateral pull of water from the root hairs.

Test yourself					
Choose the correct answer	wer:				
(1) On increasing the cor	centraion of salts	in soil, the rate of root	pressure is		
a decreased.	and the second s		d vanished.		
(2) All the following plan	ts are exposed to t	he exudation, when the	ir stem is cut close to		
	t the				
(a) maize.	b bean.	© Pinus.	d wheat.		
(3) Which of the following	g statements does	n't agree with the natur	e of cellulose ?		
a It has a colloidal r	nature.	(b) It is a support	ive substance.		
© Its presence is lim	ited in the walls o	f xylem vessels.			
d It is a substance th	at allows the water	er and solutes passage.			
Water moves fast in the p	plant at the daytim	ne and slowly at the nig	tht. Explain.		
1**************************************	*******************************		***************************************		
*4544		***************************************			
Many plants have stomat	a on the lower sur	rface of their leaves, if	the leaves of Iris		
plant float on the water surface, where do you expect their stomata are located?					
Explain your answer.					
***************************************	**********************		******* *******************************		
3	1 Choose the correct anso (1) On increasing the correct anso (a) decreased. (2) All the following plant the soil surface, excep (a) maize. (3) Which of the following a It has a colloidal record in the presence is time (d) It is a substance the water moves fast in the presence is the presence in the presence in the presence is the presence in the pr	1 Choose the correct answer: (1) On increasing the concentraion of salts (a) decreased. (b) increased. (2) All the following plants are exposed to the soil surface, except the (a) maize. (b) bean. (3) Which of the following statements doesn (a) It has a colloidal nature. (c) Its presence is limited in the walls of the day time. (d) It is a substance that allows the water. Water moves fast in the plant at the day time. Many plants have stomated on the lower supplant float on the water surface, where do	1 Choose the correct answer: (1) On increasing the concentration of salts in soil, the rate of root a decreased. (b) increased. (c) doubled. (2) All the following plants are exposed to the exudation, when the the soil surface, except the		

Transport of the manufactured food from the leaf to all the plant parts

- The phloem translocates the manufactured food sap which consists of high-energy organic substances that are produced by the leaf during photosynthesis in all directions
 - Upwards to feed the buds, flowers and fruits.
 - Downwards to feed the stem and the root system.

Role of sieve tubes in the transportation of ready made food

• Experiments had proved the role of sieve tubes in the transport of ready made food substances to all the plant parts, as the following:





Experiment



1. Steps:

- They supplied a green bean leaf with CO₂ containing a radioactive carbon (¹⁴C), in order to carry out photosynthesis process.
- 12 They traced the path of the radioactive carbohydrates in the plant.

2. Observation:

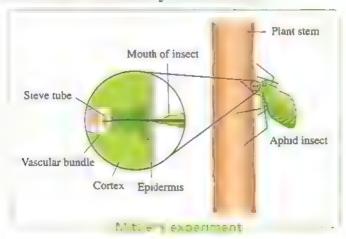
- (1) The plant produced radioactive carbohydrates.
- Carbohydrates were translocated upwards and downwards in the stem.



<u>Experiment</u>



• He used aphid insect (that feeds on the ready made food of plant) to collect the contents of sieve tubes and identify these contents.



1. Steps:

- The insect was allowed to insert its piercing mouthparts into the tissues of plant, until it reached the sieve tubes.
- He separated the whole body of insect from its mouthparts during its feeding. So, he managed to collect a sample of the sieve tubes' contents, then he analyzed the sample.
- He sectioned the region of plant tissue where the proboscis of insect was inserted.

2. Observation:

- (1) Food passes through the mouth of insect to its stomach.
 - The sample of sieve tubes consists of organic substances (sucrose and amino acids) which are manufactured in the leaves.
 - . The proboscis appeared to be inserted in a sieve tube of the plant phloem.

3. Conclusion:

The sap that was absorbed by the insect was the sap of phloem which is transported to all the plant parts through the sieve tubes.



- In 1961, the two scientists Thain and Canny could see long cytoplasmic threads which contain organic substances inside the sieve tube, and these threads extend from one tube to another through the tiny pores of sieve plates. The active circular movement of cytoplasm inside the sieve tubes and companion cells to transport the organic food substances is known as "cytoplasmic streaming".
- Therefore, we can explain the mechanism of organic substances transport in the phloem on the basis of cytoplasmsic streaming, as the following:
 - The organic substances are translocated from one end of the sieve tube to the other end during the cytoplasmic streaming.
 - These substances pass to the neighbouring sieve tube through the cytoplasmic threads which pass from one tube to another through the pores of sieve plates.
- They explained that the process of transportation in the phloem is an active process, as this activity needs energy carrier (ATP) molecules which are formed abundantly in the companion cells and transport from them through the plasmodesmata that connect the cytoplasm of companion cells with the cytoplasm of sieve tubes.
- The evidence of the validity of the cytoplasmic streaming theory is, when the temperature is decreased or in case of oxygen deficiency in the cells, the cytoplasm movement and its streaming in the sieve tubes are delayed, leading to the delay of the active transport process in the phloem.

4	Test yourself
	What would happen in the case of: companion cells were devoid of mitochondria?
	The transport process in plants that live in equatorial regions differs from the plants that live in cold regions. Explain.



Transport in Plant



The questions signed by 🥠 measure the high levels of thinking.

Interactive Test

Multiple Choice Questions

(I	In the opposite table:
	Which of the following living
	organisms represent $(X , Y \text{ and } Z)$
	respectively?

- a) Hawk Bean Spirogyra.
- (b) Spirogyra Hawk Bean.
- © Spirogyra Bean Hawk.
- d Hawk Spirogyra Bean.

Living organism	Mechanism of transport		
(X)	The raw materials transfer by diffusion and active transport.		
(Y)	Gases transfer by diffusion, while the raw materials transfer through specialized transport tissues.		
(Z)	Gases and food substances transfer through a specialized transport system.		

- Chlamydomonas alga shares Spirogyra alga in that each of them
 - (a) contains specialized transport tissues. transfers gases to it from the surrounding medium by diffusion. transfers the absorbed food substances through it by active transport. transfers the absorbed food substances and gases through it by diffusion and active transport.
- On staining a transverse section of a dicot plant stem with iodine solution, which of the following appears with dark blue colour?
 - (a) Xylem vessels.

(b) Companion cells of phloem.

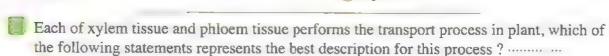
Cambium.

- d The innermost row of cells in cortex.
- The opposite diagram shows a T.S. of a plant root, (Q) shows the part that is stained red when the root is placed in water containing a red dye. What is found at (O)? -----
 - . Guard cells.

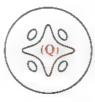
b Palisade cells.

Phloem.





- . Xylem transports water upward and phloem transports food downward. Xylem transports water and salts upward, and phloem transports the ready made sap downward.
- . Xylem transports water and salts, and phloem transports the ready made sap.
- . Xylem transports the ready made sap upward, and phloem transports water and salts downward.

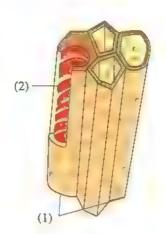


	each of the plant s	wing statements doesn'tem and leaf?	t agree with the cells tha	t form the outer layer of				
	a One row of par							
	6 Adjacet barrel-							
		ith a layer that is imper	meable to water					
		cells that have a storage						
7								
	the leaf?	Which of the following tissues is present in the plant stem and is not present in the leaf?						
	a Xylem.	b Phloem.	© Cambium.	d Epidermis.				
8	The opposite figur	e represents a section in	a plant	(1)				
		umber of tissue that is s		(1)				
		organic food substance		(5 A A)				
	the different parts	of the plant?						
	a (1).		(b) (2).					
	© (3).		(d) (4).	(4) (3)				
9	All the following don't have the ability to divide, except the							
	tracheids.	,	b well-advanced					
	© sieve tubes.		d companion cell					
10	In the opposite fig			77				
	(1) All the following because it is							
	except that		the structure no. (2),	(1)				
		ill lose its source of ene	rov					
		on't be able to divide.	26J·					
		of tissue will stop.		(2)				
	d the tissue changes into a xylem tissue.							
	(2) The structure no.(1) shares structure no. (2) in containing							
	b cytoplasm.			6880				
	© mitochondr	ia.		Y It				
	d nucleus.							
				_				
11		Which of the following participate(s) mainly in transporting water in the stems						
	of plants ?	b #	0					
	a Xylem tissue.		b Vascular bundle	s.				
	© Vessels only.		d Tracheids only.					



- Which of the following describes the structure of a dicot stem?
 - (a) It contains a ring-shaped vascular bundle.
 - (b) It contains central vascular cells.
 - c It contains several layers of xylem that are surrounded by a ring of phloem.
 - 1 It contains vascular bundles that scattered through the pith tissue.
- The following figure shows a group of cells that are adapted to perform a certain function:
 - (1) The cells no. (1) and (2) represent ····· respectively.
 - (a) vessels and tracheids
 - (b) sieve tubes and companion cells
 - © epidermal cells and cortex cells
 - d sclerenchyma cells and meduliary rays
 - (2) The function of cells no. (1) and (2) is
 - a transporting food substances.
 - b transporting water.
 - c manufacturing food.
 - d storing food.
 - (3) The cells no. (1) share cells no. (2) in
 - ... performing the photosynthesis process.
 - b their transverse section.
 - c their thickening with cutin.
 - d the stages of their formation.
- 14 In the opposite figure:
 - (1) What happens if the tissue no. (1) is removed?
 - (a) The xylem will not be formed.
 - b The phloem will not be formed.
 - © Nothing will occur.
 - d Each of the xylem and phloem will not be formed.
 - (2) The tissue no. (2) is considered non-living, because
 - a it is a xylem tissue.

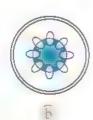
- b its cells' walls are thick.
- © its cells don't contain a nucleus or cytoplasm.
- d it can't absorb water.

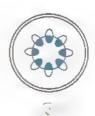


- (3) Which of the following is considered from the functions of tissue no. (3)?

 - Transporting water and salts only. Transporting the high-energy food only.
 - . Transporting water, salts and high-energy food to all the plant parts.
 - d Storing the food.
- A plant was placed in water containing a blue dye for 24 hours, then it was removed, after that several sections of the stem were taken. Which of the following figures illustrates that ?









- All the following consist of parenchyma cells, except
 - a stem's epidermis.

b leaf's epidermis.

c cambium tissue.

- d stem's pith.
- What is the substance that transported in the phloem? And what is the direction of transport?
 - (a) Starch / Upward and downward.
- (b) Starch / Upward only.
- Sucrose / Downward and upward.
- J Sucrose / Downward only.
- By which process is the water lost from a leaf during transpiration?
 - a Active transport.

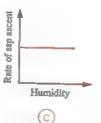
b Diffusion.

C Osmosis.

- d Photosynthesis.
- Which of the following graphs shows what will happen to the rate of sap ascent, when the humidity increases ?











- The opposite figure shows a potted plant and the same plant after 24 hours. What is the reason for the change in the plant appearance?
- 24 hours
- ... The amount of water lost is greater than the amount of water uptake.
- b Water moves from the leaves to the stem.
- The amount of water uptake is equal to the amount of water lost.
- The amount of water uptake is greater than the amount of water lost.
- Some liquid is collected from the xylem of a plant stem. What is the substance that present in this collected liquid?
 - a Cellulose.

(b) Inorganic ions.

© Starch.

d Sugar.

The following table shows some characteristics of four different plants that grow in the same environmental conditions, which plant of them will have the highest rate of transpiration?

	No. of leaves of the plant	Average surface area of a leaf / cm ²	No. of stomata on leaves of the plant	Average diameter of a stoma / µm
a	12	42	248	19
5	25	20	250	16
C	35	52	275	18
a	35	45	150	15

- Which of the following statements doesn't agree with the nature of lignin?
 - a It is a substance with a colloidal nature that has the ability to imbibe water.
 - b' It may take many shapes, such as spiral and annular inside the xylem vessel.
 - It is a supporting substance that supports the xylem vessel and prevents its collapse.
 - d It is a permeable substance to water and solutes.
- Which of the following substances have the ability to absorb water, but they are insoluble in it?
 - (a) Cellulose and cutin.

b Pectin and suberin.

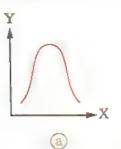
© Pectin and lignin.

d Cellulose and subrin.

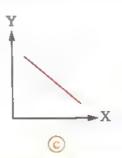
- Which of the following is not from the factors that allow the ascent of water in the plant? a Root pressure. (b) Cohesion force among water molecules. © Transpiration process. d Active transport process of food in the sieve tubes. The presence of a continuous attraction of water upward inside the xylem vessels is due to the force(s). adhesion. transpiration pull all the previous n cohesion Which of the following doesn't agree with keeping the water columns held continuously inside the xylem vessels of the plant? The a adhesion force among water molecules. bentry of cellulose substance in its structure. c entry of lignin substance in its structure. (d) xylem vessels are devoid of bubbles. In the opposite figure: Which of the following produces the energy required for sugar transport through the plant? (a) (A). (C). d (D). Parenchyma 1 4 1
- The colloidal nature of xylem vessels' walls plays a role in all the following, except · · · ·
 - a the occurrence of imbibition phenomenon.
 - b the presence of cohesion force.
 - the existence of water columns held against the effect of gravity.
 - d the presence of adhesion force.
- What is the main source of energy that helps in the ascent of water in the plant stem?
 - The difference in osmosis between the sap that presents in the cell and water that presents in the soil.
 - b The absorbed heat from the Sun.
 - © The light absorbed by chlorophyll.
 - The combustion of sugar resulted from the photosynthesis.

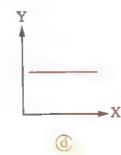


- The rate of sap ascent during the day is its rate during the night in the plant.
 - a more than
- (b) equal to
- c less than
- d varied from
- Which of the following elements is/are not found in the food of aphid insect, when its examined?
 - (a) Amino acids.
- (b) Fatty acids.
- © Sucrose.
- d Water.
- Which of the following graphs shows the relation between the rate of sap ascent in plant (Y) and the rate of photosynthesis (X)?

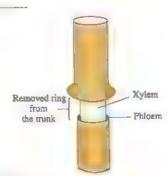


Y X

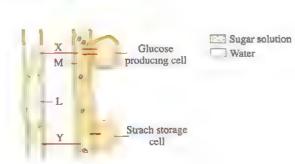




- In the opposite figure, when removing a ring from the plant's trunk, which of the following is expected to happen?
 - (a) Water will not reach the roots.
 - b Water will not reach the leaves.
 - © Dissolved solutes will not reach the leaves.
 - d Amino acids and sugar will not be transported to the roots.



- Which of the following works on increasing the active transport process in phloem?
 - a Decreasing the temperature and oxygen deficiency.
 - b Decreasing the temperature and increasing the oxygen.
 Increasing of both the temperature and the concentration of oxygen.
 - d Increasing the temperature and decreasing the oxygen.
- Using the opposite figure:
 - (1) (M) represents
 - .. companion cell.
- sieve tube.
- © xylem vessel.
- d root hair.
- (2) (L) represents
- a companion cell.
- **b** sieve tube.
- © xylem vessel.
- d root hair.



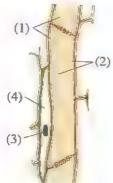
- (3) The processes represented by (X) and (Y) are
- (X) is osmosis and (Y) is active transport. b (X) is active transport and (Y) is osmosis.
- both of (X) and (Y) are osmosis.

 J both of (X) and (Y) are active transport.

Miscellaneous Questions

- "The Spirogyra alga contains developed vascular bundles".

 How far this statement is correct? With explanation.
- Choose the anomalous word from the following, then mention what links the rest:
 - (1) Epidermis / Pericycle / Cambium / Pith.
 - (2) Vessels / Tracheids / Sieve tubes / Phloem parenchyma.
- 3 The components of the vascular bundle for each of the stem and leaf of a dicot plant are different. Explain this.
- From the opposite figure:
 - (a) What is the importance of structures no. (2) and (4)?
 - (b) What is the role of plasmodesmata between the two structures no. (1) and (4)?
 - (c) What happens in case of the absence of the structure no. (3)?



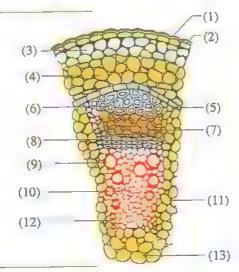
- You have two plants (A) and (B) of the same species and belong to dicotyledonous plants, but one of them is older than the other. How can you make sure of this practically?
- What happens in case of: the absence of meristematic cells from the stem of a new dicot plant?
- Explain: the cells of root obtain their food, although they don't contain chlorophyll and are not exposed to light.
- Explain: the xylem tissue contains living cells, although it is a non-living tissue.
- What is the relation between: xylem vessels and lignin substance?



- The opposite figure represents two structures for transporting water and salts in the plant:
 - (a) Deduce the reason for non-collapsing of the wall of structure no. (1) inward.
 - (b) Determine which of the two structures no. (1) or (2) has a greater role in the transport process in the plant. Explain your answer.
 - (c) The structure no. (1) is characterized by several characters that had a role in explaining the forces which work on the ascent of sap in plant. Explain this.
 - (d) What happens in case of the absence of structure (X)?
- What is the relation between: xylem vessels and the presence of pits?
- Deduce how the following structures are suitable for their functions:

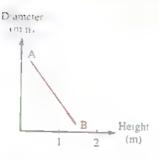
 (1) Xylem. (2) Phloem.
- "Transport process in the plant takes place through a group of living tissues".

 How far this statement is correct? With explanation.
- In plants, there are tissues that are related to the transport function . Determine :
 - (a) The name of these tissues.
 - (b) The type of substances that are transported through these tissues.
 - (c) The transport direction in each of these tissues.
- The opposite figure illustrates the internal structure of the plant stem:
 - (a) What is the function of the two structures no. (3) and (5)?
 - (b) Determine the name and number of non-living structures that are penetrated by living cells.
 - (c) The sites of presence of parenchymatous tissue are numerous in this figure. Illustrate this.

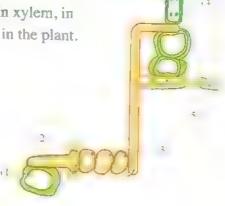


Explain: there are many supporting cells for the cotton plant stem that differ in their site of presence.

- 17 The opposite graph illustrates the relation between the water height in xylem vessels and diameter of these vessels using a physical property:
 - (a) Explain the curve (AB).
 - (b) Why is the curve stopped at (B)?
 - (c) What do you expect to happen if the diameter of vessels was more than I cm?



- 18 Give reason: the hydrogen bonds that bind the water molecules with each other have a role in the ascent of sap in plant.
- Give reason: the nature of xylem plays a role in the ascent of water inside the xylem vessels.
- Water is transfered from the root to the leaves, according to the following arrangement: cortex - stomata - mesophyll tissue - root hair - xylem'. How far this statement is correct? With explanation.
- 21 Explain: the radioactive elements have an important role in studying the transport process in bean plant.
- 22 The opposite figure illustrates a diagram for the xylem vessels in a dicot plant:
 - (a) Mention three forces acting on the ascent of water in xylem, in the light of your study for the theories of sap ascent in the plant.
 - (b) Deduce the functional suitability of the structures no. (2) and (4).
 - (c) What happens in case of cutting the plant at the part no. (3)?



- 23 Bean plant absorbs water and mineral salts by roots, and obtains carbon dioxide gas through stomata". In the light of this:
 - (a) Mention the site in which carbon dioxide gas diffuses.
 - (b) Follow the route that passed by water, saits and carbon dioxide, till reaching the site of their consumption in the plant.
 - (c) Determine the type of compounds that formed as the final products



- "Capillarity phenomenon and transpiration process play an important role in water movement through the plant". Illustrate which of these two processes participates more in the upward movement of water in the tree trunk. Explain your answer.
- "The mechanism of transport of organic materials in phloem had been explained on the basis of cytoplasmic streaming". How far this statement is correct? With explanation.
- What is the relation between: companion cells and cytoplasmic streaming movement?
- Poplain: when the soil is saturated with water, as a result of the excessive irrigation, the transport process through phloem decreases.
- What is the relation between; obtaining oxygen and transport process in the plant?
- Explain: the transport process in plant is affected by external factors.
- Give reason: the slow movement of cytoplasm and its streaming in the sieve tubes.



 Animals obtain their requirements of energy in the form of food which is digested, then soluble food substances are absorbed, but the problem of their transport and distribution to the various tissues laying far away from the surface of absorption still remains.

- In small animals (as Protozoa and Hydra):

Both respiratory gases and food substances are transported by diffusion, therefore these small animals don't need specialized transport systems.

- In bigger and more complicated animals:

Diffusion is not sufficient for the transportation of food and oxygen to the various tissues. Therefore, the presence of a specialized transport system is essential in these animals.

Test.	yourself
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The transport process in the live body complexity. Discuss.	ing organism depends on the degree of its evolution and its
**** ****** *** ***************	

• Transport in human :

The process of transport in the human body takes place through two systems which are closely connected with each other, these systems are:

- Circulatory system (Blood vascular system).
- Lymphatic system.

Circulatory system

 Circulatory system in human is considered from the closed type, as the heart and blood vessels are connected together in a complete circuit through which the blood passes and never get out from it to the body cavity.





Heart

Description

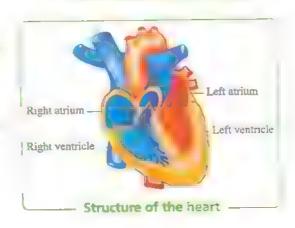
- It is a hollow muscular organ which lies nearly in the middle of chest cavity (towards the left slightly).
- It is surrounded by the pericardium membrane to protect the heart and facilitate its action (movement).
- The heart beats (contracts and relaxes) regularly throughout the whole lifetime.





Structure

- The heart consists of four chambers, and it is divided:
 - Transversely into:
 - · Atria Auricles : the upper two thin-walled muscular chambers which receive the blood.
 - · Ventricles: the lower two thick-walled muscular chambers that pump the blood.
 - Longitudinally into two sides by means of muscular walls:



Right side

Each of them has an atrium and a ventricle that are connected together through an opening which is guarded by a valve with thin flaps. Left side

• Heart valves which include:

Type

Location

Function



Right tricuspid valve (consists of 3 flaps):

Lies between the right atrium and right ventricle.

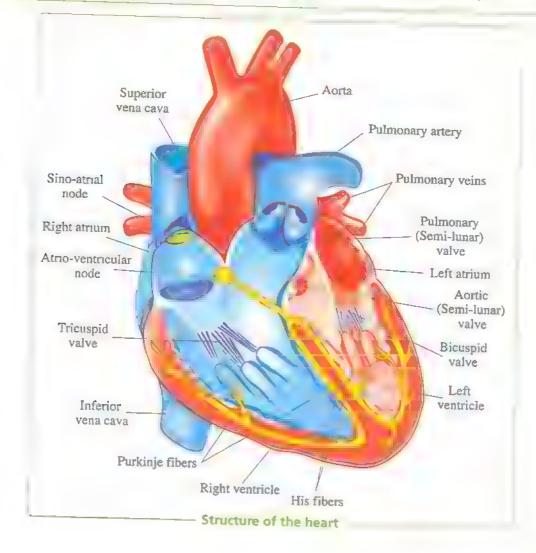
Allows the blood to pass from the atrium to the opposite ventricle in one direction, (i.e. it prevents the return back of blood to the atrium).

Left bicuspid valve
"Mitral valve"
(consists of 2 flaps):

Lies between the left atrium and left ventricle.

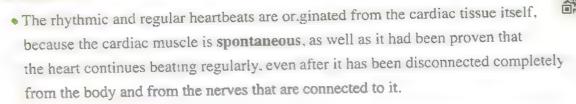
Semi-lunar valves "Aortic valve & pulmonary valve" : Present at the connection of the heart with both the aorta and the pulmonary artery.

Allow the blood to pass from the two ventricles to inside the arteries in one direction. (i.e. they prevent the return back of blood to the two ventricles).





Heartbeats



Origin of heartbeats

- The regular rhythmic of heartbeat is related to the presence of sino-atrial node which is:
 - A specialized bundle of muscular fibers that is buried in the right atrial wall and near to the site of its connection with the large veins.
 - Considered the pacemaker of heart, as it beats with a regular rate of 70 beat/minute (normal rate), and it is connected with two nerves that affect this normal rate, which are:
 - A nerve that decreases the rate of heartbeats.
 - · A nerve that increases the rate of heartbeats.

Do you know ... ? ---

- The nerve that decreases the rate of heartbeats is known as "Parasympathetic nerve'.
- The nerve that increases the rate of heartbeats is known as "Sympathetic nerve".

So, the number of heartbeats changes according to the physical and psychological states of the body.

• For Example :

- The rate of heartbeats decreases: during sleeping sadness states (grief).
- The rate of heartbeats increases: gradually after waking up joy states performing vigorous physical efforts.

Note

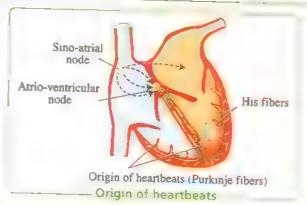
In the normal age of man, the heart beats by a range of 70 beat/minute, therefore it pumps 5 liters of blood in each minute which is equal to the total amount of blood in the body.

Mechanism of heartbeats



- Sino-atrial node sends the contraction impulse spontaneously, therefore it stimulates the muscles of atria to contract.
- The electrical nerve impulse reaches the atrio-ventricular node that present at the site of connection of atria with ventricles.

The impulse will spread rapidly from the atrio-ventricular node through special fibers (His fibers), then spread from the inter-ventricular septum to the wall of both ventricles, where it stimulates their muscles to contract.



Sound of heartbeats

- We can distinguish the heartbeats into two sounds, as follows:
 - Long and low-pitched (Lubb) sound: due to the closure of the two valves between the atria and ventricles during the ventricular contraction.
 - ② Short and high-pitched (Dupp) sound: due to the closure of the aortic and pulmonary valves during the ventricular relaxation.

Test yourself

Study the opposite graph which illustrates
the rate of heartbeats of a person during
the day, then determine the time that represents

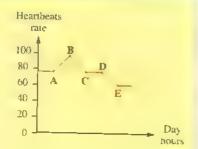
(a) AB

(b) DE

doing a physical exercise

© BC

(d) CD



"The difference in the thickness of walls of heart chambers is related to their function".

How far this statement is correct? With explanation.

Teromi

Blood Vessels

- The blood vessels in the human body include:
 - Arteries.
- Veins.

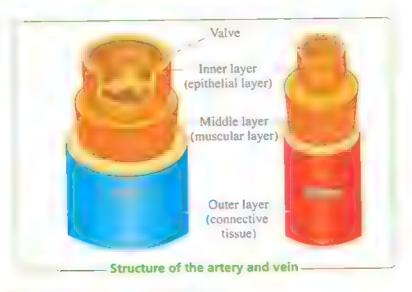
Blood capillaries.

1 Arteries

They are vessels that carry the blood from the heart to the other body parts, and usually found buried among the body muscles.

2

- All arteries carry oxygenated blood, except the pulmonary artery which comes out from the right ventricle to the two lungs, carrying deoxygenated blood.
- The wall of artery is built up of three layers as follows:



- Outer layer: it consists of a connective tissue.
- Middle layer: it is relatively thick and consists of involuntary muscles which contract and relax under the control of nerve fibers, thus it can pulsate.
- Inner layer (Endothelium): it consists of one row of thin epithelial cells that is topped with elastic fibers which acquire the artery with the required elasticity to be able to pump the blood during the contraction of ventricles.

2 Veins

- They are vessels that carry the blood from all the body parts to the heart.
- They carry deoxygenated blood, except the pulmonary veins which open into the left atrium (auricle), carrying oxygenated blood.
- The wall of vein is composed of the same layers of artery, but :
 - The elastic fibers are rare.
 - The middle layer is less thick. So, the wall of vein is thinner than that of the artery, and it doesn't pulsate.
- There are valves in some veins to prevent the backflow of blood, allowing only its passage in the direction of the heart, such as the limbs veins that are near to the skin surface, and the sites of these valves can be observed in the arm veins, when the arm is tied tightly with

a bandage (tourniquet) above the elbow. This was done by the English doctor "William Harvey" who studied the blood circulation in the 17th century after being discovered by the Arab doctor "Ibn Al-Nafis" in the 10th century.







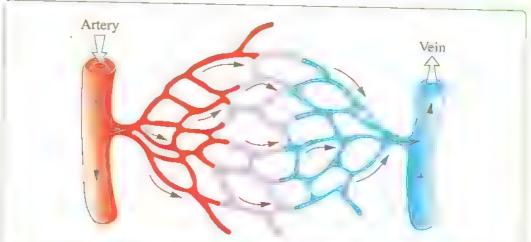
William Harvey

Capillaries

- They are tiny microscopic vessels which connect the artery branches (arterioles) with the vein branches (venules).
- This fact was discovered by the Italian scientist "Malpighi" at the ends of 17th century, and thus he completed the work of doctor "Harvey".



Malpighi



- Connection between the arterioles and venules by the bood capillaries
- Blood capillaries spread in the spaces between cells of all the body tissues to be able to reach all the cells and supply them with their requirements of food and oxygen.



Enlarged blood capillary

- Its wall: it is very thin that consists of one cellular layer (whose thickness is about 0 00001 mm), and it is considered one row of thin epithelial cells with tiny pores between them which facilitates the quick exchange of substances between the blood and cells of tissues.
- Its diameter: ranges from 7:10 micron.



From the previous, we can compare between the arteries, veins and blood capillaries, as follows:



P.O.C.	Arteries	Veins	Blood capillaries
			0
Structure of the wall	Consists of three layers: Outer: connective tissue. Middle: thick and consists of involuntary muscles. Inner: one row of epithelial cells that topped with elastic fibers.	Has the same structure of arterial wall, but the middle layer is less in thickness and there are less elastic fibers (rare).	Consists of one row of thin epithelial cells with tiny pores between them.
Wall thickness:	Thicker than the veins.	Thinner than the arteries.	Very thin.
Ability to pulsate:	Pulsate	Don't pulsate.	
Presence of valves:	They don't have valves (except at the beginning of aorta artery and pulmonary artery).	The presence of internal valves in some veins, especially those present near the skin.	Absent
Direction of blood:	From the heart to all the body parts.	From all the body parts to the heart.	From the arterioles to the venules.
Type of carried blood:	Oxygenated blood (light red), except the pulmonary artery.	Deoxygenated blood (dark red), except the pulmonary veins.	Oxygenated blood in the blood capillaries at the end of arterioles (except the pulmonary artery), and deoxygenated blood in the blood capillaries at the beginning of venules (except the pulmonary veins).
Location :	Found buried among the body muscles.	Some of them are present near the skin.	Spread in the spaces between cells of all the body tissues.

Test yourself.

1 Choose the correct answer:

Which of the following blood vessels contains the highest level of O_2 and the lowest level of CO_2 ?......

- a Aorta.
- © Superior vena cava.

- D Pulmonary artery.Inferior vena cava.
- The structure of blood vessels in human stats their functions. Discuss this statement.

Blood



- It is considered the principal medium in the transport process.
- Colour : red viscous fluid.
- pH: equals 7.4 (weak alkaline).
- Volume: 5 6 liters of blood on average are present in the human body.
- Structure: fluid connective tissue that consists of:
 - Plasma.
 - Red blood cells (corpuscles).
 - White blood cells (corpuscles).
 - Blood platelets.

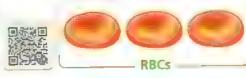
Plasma

- It is the interstitial substance in the blood.
- It represents 54% of the blood volume and consists of:
 - -90% water.
 - 1% inorganic salts, such as Ca²⁺, Na⁺, Cl⁻ and (HCO₃)⁻ salts.
 - -7% proteins, such as albumin, globulin and fibrinogen.
 - 2% other components, such as the absorbed food (sugars and amino acids), hormones, enzymes, antibodies and wastes (urea).



RBCs - Red blood corpuscles (Erythrocytes)

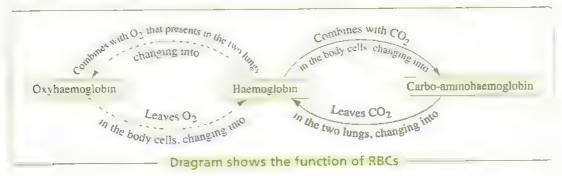
- Number: they are considered the most abundant blood cells, as the body of:
 - Adult male contains 4:5 million cell/mm³ of the blood.
 - Adult female contains 4: 4.5 million cell/mm3 of the blood.
- Description: round-shaped corpuscles and biconcave.
- Origin: they are formed in the bone marrow of adult human, where 100 million new red blood cells are produced every minute to replace the old others.
- Average age of the cell: doesn't exceed 4
 months, where they spend circulating inside
 the blood circulation about 172,000 times.



Note

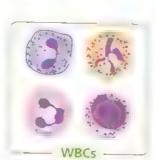
After the breaking down of old red blood corpuscles, the body restores the proteins that found in RBCs to use them in the formation of bile juice which plays an important role in the digestion of fats.

- Destruction site: they are destroyed after ending their short age in the liver, spleen and bone marrow.
- Structure: enucleated cells (have no nucleus) contain large amounts of "haemoglobin" which consists of protein and iron, and it acquires the blood its red colour.
- Functions:
 - Transporting oxygen from the two lungs to all the body parts, as follows:
 - The haemoglobin of red blood corpuscle combines with the oxygen that presents in the two lungs, to form a new pale red substance "oxyhaemoglobin" (arteries blood).
 - The oxyhaemoglobin leaves the oxygen, when it reaches the different body cells and changes into haemoglobin again.
 - Transporting carbon dioxide from all the body parts to the two lungs, as follows:
 - The haemoglobin combines with carbon dioxide that presents inside the body cells to form a new dark red substance "carbo-aminohaemoglobin" (veins blood).
 - Carbo-aminohaemoglobin leaves carbon dioxide, when it reaches the two lungs and changes into haemoglobin again.



WBCs - White blood corpuscles (Leucocytes)

- Number: they are about 7000 cell/mm³ of blood, and this number increases during diseases.
- Description: colourless and nucleated corpuscles with many shapes (have no specific shape).
- Origin: they are formed in the bone marrow, spleen and lymphatic system.
- Average age of the cell: some of their types live for 13: 20 days.
- has a specific function, but their main function is the protection of body against the infectious diseases, as the following:
 - Attacking the microbes (surround them, then engulfing them).
 - Stopping the foreign substances that produced by the microbes in blood.
 - Getting rid of dead cells and other wastes.
 - Producing antibodies through specific types of white corpuscles.

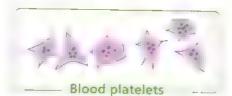


Note

The white blood corpuscles circulate continuously in the body, streaming along the walls of blood vessels, as well as they have the ability to spread among the cells of blood capillaries walls.

Blood platelets

- Number: 250,000 platelet/mm³ of blood.
- Description: non-cellular and very small-sized particles.
- Size: about one fourth of the RBCs
- Origin: produced from the bone marrow.
- Average age of blood platelets: live for about 10 days, as they are regenerated continuously.



- Function: play an important role in the blood clotting process after the injury.
- From the previous, we can compare between RBCs, WBCs and blood platelets, as follows:

P.O.C.

RBCs

WBCs

Blood platelets

Origin:

Bone marrow.

Bone marrow, spleen and lymphatic system.

Bone marrow.



	Biconcave round-shaped cells.	Don't have a specific shape, as there are many types of them.	Non-cellular and small-sized particles.
Shape :	999		和人命令号
Number/ mm³ of blood :	Adult male —> 4:5 million cells. Adult female —> 4:4.5 million cells.	7,000 cells and this number increases in case of diseases.	250,000
Average age:	120 days (doesn't exceed 4 months).	Some types live for 13: 20 days.	About 10 days, as they are regenerated continuously.
Function :	 Transport O₂ from the two lungs to the different body cells Transport CO₂ from the different body cells to the two lungs. 	Protecting the body through: Attacking the microbes. Stopping the foreign substances that produced by microbes. Getting rid of dead cells and wastes. Producing antibodies through specific types of white blood corpuscles.	Play an important role in the blood clotting process after injuries.
Colour:	Red, due to the presence of haemoglobin substance.	Colourless	
Presence of nucleus:	Enucleated	Nucleated	



(Thoose the correct answer:

(1) The blood corpuscles and blood platelets in human represent of blood volume.

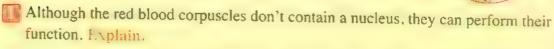
(a) 10%

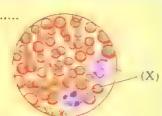
(b) 46%

© 54%

(d) 90%

- (2) From the opposite figure, the functin of the cells (X) is
 - a transporting O2
 - (b) transporting hormones.
 - © blood clotting.
 - d the resistance of diseases.







- It occurs when a blood vessel is cut or teared.
- Importance of clotting: protecting the blood by preventing the bleeding, in order not to lose large amount of it, exposing the body to a shock that is followed by death.
- Factors of coagulation (clotting) of blood :
 - 1 Exposure of blood to air.
- 2 Friction of blood with a rough surface, such as destroyed cells and vessels.

Stages of the blood clot formation:

Mechanism of blood clotting

- In case of the presence of blood clotting factors, its steps are as the following:
 - 1 The blood platelets together with the destroyed cells (in the injury site) form a protein substance called "thromboplastin".

Thromboplastin stimulates the conversion process of prothrombin into thrombin in the presence of calcium ions (Ca⁺⁺) and blood clotting factors in the plasma.

Prothrombin
(Protein secreted by the liver with the help of vitamin K and poured in the blood)



1 Thrombin catalyzes the conversion of fibrinogen into fibrin.

Fibrinogen

Thrombin

Fibrin

(Soluble protein in plasma)

(Insoluble protein)

• Fibrin precipitates in the form of a network of microscopic interlacing fibers in which the blood cells are aggregated, forming a clot which blocks the cut in the damaged blood vessel to stop the bleeding.

Reasons for the non-clotting of blood inside the blood vessels

- 1 Blood flows in a normal fashion inside the blood vessels without slowing down.
- @ Blood platelets slide easily and smoothly inside the blood vessels without being broken.
- The presence of heparin substance that is secreted by the liver and prevents the conversion of prothrombin into thrombin.

Test yourself

Choose the correct answer:

- (1) Which of the following is believed to be a reason for haemophilia (blood liquidity) disease? The
 - a increase of calcium percentage in blood
 - (b) increase of vitamin K percentage in blood
 - c increase of blood platelets percentage in blood.
 - (d) absence of one of the blood clotting actors from blood
- (2) Which of the following substances can be used to prevent the clotting of blood samples in the tubes, during carrying ou the laboratory tests.
 - (a) Thromboplastin
- b Prothrombin
- (c) Fibrinogen
- (d) Heparin

Functions of the blood

- The blood has several functions, due to its unique structure, which are as follows:
- Transportation:
 - It transports the digested food substances, excretory nitrogenous compounds, hormones and some enzymes (active or inactive) through the plasma.
 - It transports oxygen and carbon dioxide through RBCs
- **@** Regulation :
- It regulates the processes of metabolism.

- It keeps the body temperature at 37°C.
- It regulates the internal environment (homeostasis) of body, such as (osmotic potential, amount of water and degree of pH in the tissues).

1 Protection:

- It protects the body against the invasion of microbes and pathogenic organisms through the white blood corpuscles.
- It protects the blood itself against the bleeding by the help of blood platelets which play an important role in the formation of blood clot.

- Blood circulates within the arteries, veins and minute blood capillaries by the heartbeats, but:
 - It passes smoothly and easily in the arteries and veins.
 - It doesn't pass smoothly and easily in the minute blood capillaries, due to their resistance against this heavy viscous fluid. So, it needs a pressure which called "blood pressure".
- The blood pressure increases: on the contraction of two ventricles, and the highest blood pressure is measured in the arteries that are near to the heart.
- The blood pressure decreases: on the relaxation of two ventricles, and the blood pressure decreases as we go far from the arteries that are near to the heart, till it reaches its minimum value in the venules and blood capillaries (about 10 mm Hg). So, the returning of blood in the veins to the heart depends on the skeletal muscles that surround veins and the valves that present in these veins.

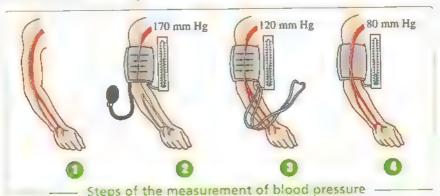
Measurement of blood pressure

- The blood pressure is measured by means of mercuric instruments called "sphygmomanometers", which give two numbers:
 - Upper number: measured during the ventricular contraction which represents the maximum blood pressure.
- Lower number: measured during the ventricular relaxation which represents the minimum blood pressure.
- Example: the normal value of blood pressure in a healthy youth is 120/80 mm Hg. So, the number of 120 mm Hg represents the blood pressure during ventricular contraction (systolic), and 80 mm Hg represents the blood pressure during ventricular relaxation (diastolic).



Sphygmomanometer

- Structure: a mercuric tube and a scale board.
- Idea of working: blood pressure can be measured according to the elevation of mercury level inside the tube and it is represented by a number on the scale board.



Method of measurement :

The blood pressure can be measured by listening to the heartbeats, and also between one beat and another, as the following:



- The doctor listens to the sound of heartbeats by the stethoscope.
- On hearing the sound of heartbeat, the doctor can determine the number, referring to the ventricles contraction (systolic).
- When the sound disappears, the doctor can determine the number, referring to the ventricles relaxation (diastolic).

70:35

- (1) The blood pressure increases gradually by aging, and it may reach a dangerous case, if it is not cured under medical control.
- (2) There are some digital instruments to measure the blood pressure, but they are not accurate as the mercuric instrument.

6

Test yourself

Choose the correct answer:

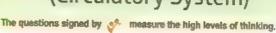
The lowest value of the blood pressure in human is when

- a contracting the left atrium.
- (b) relaxing the right atrium.
- c the closure of bicuspid valve.
- d the closure of tricuspid valve.



Human Transport System

(Circulatory System)





Interactive Test



Multiple Choice Questions

- Which of the following prevents the backflow of blood to the right atrium, when the right ventricle contracts?
 - . Tricuspid valve.

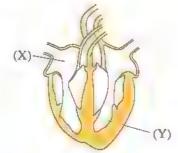
b Bicuspid valve.

Semi-lunar valve.

. Mitral valve.

The opposite figure shows a vertical section through the human heart, what do (X) and (Y) represent?

(X)		(Y)	
a	Left atrium	Right ventricle	
6	Left ventricle	Right atrium	
©	Right atrium	Left ventricle	
(d)	Right ventricle	Left atrium	



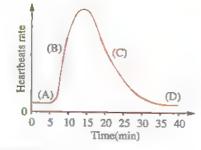
3 The opposite graph shows the effect of several minutes of vigorous exercises on the heartbeats rate, which letter represents the time of doing these exercises?



(b) (B).



(d) (D).

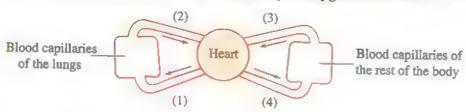


- Which of the following statements doesn't agree with the valves?
 - They present at the connection of the heart with pulmonary and aorta arteries.
 - b They present at the connection of the heart with superior and inferior venae cavae.
 - They allow the passage of blood from atrium to its opposite ventricle.
 - They allow the passage of blood from two ventricles to inside the arteries in one direction.
- All the following statements agree with the sino-atrial node, except that
 - it is a bundle of muscular fibers that buried in the wall of right atrium of the heart.
 - b it is the pacemaker of the heart.
 - © it stimulates the muscles of two atria to contract.
 - d it stimulates the muscles of two ventricles to contract.



u				
6	Which of the following is considered the cor	rect path for the transfer of contraction		
	impulse to the muscles of ventricles?			
	a Sino-atrial node → His fibers →	Wall of ventricles.		
	(b) His fibers — Sino-atrial node — Y	Wall of ventricles.		
	Sino-atrial node	trio-ventricular node		
	Atrio-ventricular node → His fibers –	— Wall of ventricles.		
7	Which of the following groups represents th	e blood vessels carrying oxygenated blood?		
	(a) Aorta - Pulmonary artery - Renal artery			
	6 Aorta - Pulmonary vein - Renal artery.			
	© Venae cavae – Pulmonary artery – Renal	vein.		
	d Venae cavae – Pulmonary vein – Renal v	rein.		
8	Which of the following blood vessels co dioxide and the highest percentage of oxyge			
	a Pulmonary vein.	b Superior vena cava.		
	© Pulmonary artery.	d Inferior vena cava.		
9	Which blood vessel contains valves?	****		
	Arteriole. Blood capillary	. Renal artery. Renal vein.		
10	Which of the following statements is correct:	about the veins of the left leg?		
	Blood vessels carry blood at high pressures.			
	b Pulsating blood vessels.			
	© Blood vessels contain valves.			
	d Blood vessels carry blood away from the	e heart.		
11	Which of the following doesn't agree with the	e characteristics of pulmonary vein ?		
	a It carries oxygenated blood.			
	(b) It has a wider lumen than that of the pul-	monary artery.		
	The thickness of its wall is thinner than	that of the pulmonary artery's wall.		
	d It carries deoxygenated blood.			
12	The following figure illustrates the passa	age of blood in a blood vessel from		
	foot to heart.	b liver to intestine.		
	© heart to kidney.	d heart to two lungs.		

In the following figure, which blood vessels carry deoxygenated blood?



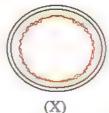
- (a) (1) & (2).
- **(b)** (1) & (3).
- © (2) & (3).
- **(1)** (2) & (4).

Direction of

the blood flow

- In the opposite figure:
 - (1) Which of the following statements doesn't agree with the structure no. (1)?
 - (a) Its wall contains valves.
 - (b) It carries blood to the heart.
 - © It is not a pulsating blood vessel.
 - d It carries oxygenated blood.
 - (2) Which of the following doesn't agree with the characteristics of the structure no. (2)?
 - (i) It carries oxygenated blood.
- b It carries deoxygenated blood.
- © It carries blood away from the heart.
- d It has the highest blood pressure.







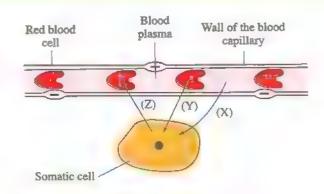


Which of the following refers to the correct arrangement for each of (X), (Y) and (Z) respectively?

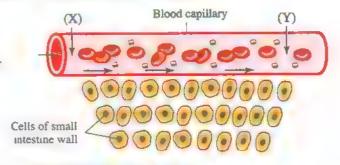
- .. Artery Blood capillary Vein.
- Blood capillary Vein Artery.
- Vein Blood capillary Artery.
- ... Vein Artery Blood capillary.
- Which of the following is considered from the characteristics of blood vessels that connect between the artery and vein?
 - a They contain valves.
 - b Their wall consists of several cellular layers.
 - © Their wall consists of connective tissue.
 - d Their wall contains tiny pores.



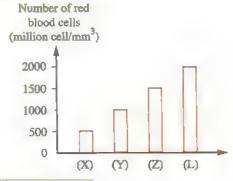
- In the opposite figure,
 the symbols (X, Y and Z)
 represent ----- respectively.
 - a oxygen, carbon dioxide and glucose
 - b glucose, oxygen and carbon dioxide
 - carbon dioxide, oxygen and glucose
 - d oxygen, glucose and carbon dioxide



- In the opposite figure, which of the following substances its / their concentration at the point (Y) is higher than that at the point (X)?
 - a Oxygen.
- **b** Starch.
- (c) Amino acids.
- d Urea.



- All the following proteins present in the blood plasma in the normal state, except the
 - albumin.
- (b) globulin.
- © fibrinogen.
- d fibrin.
- Which of the following substances may present dissolved in the blood plasma?
 - .. Glucose, hormones and urea.
 - CO₂ gas, haemoglobin and glucose.
- ⁵ CO₂ gas, O₂ gas and haemoglobin.
- d O2 gas, urea and starch.
- In the opposite figure, which column represents the red blood cells number that are formed through 15 minutes?
 - "`(X).
- (b) (Y).
- (c)(Z).
- (d)(L).

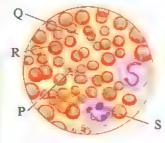


- The number of red blood corpuscles increases in people who live in higher altitudes, due to the decrease of
 - a CO₂
- **(b)** O₂
- © haemoglobin.
- d iron.

a Heart.	(b) Two kidneys.	© Liver.	d Two lung
Which substance o	f the following is transpor	ted by haemoglobin	1?
a Nitrogen.	(b) Oxygen.	© Urea.	d Water.
	suffers from an inflammat	ion in the appendix	, an increase
in the app	pears in his blood.		
(a) enzymes		blood platele	ets
© white blood cor	puscles	d red blood co	rpuscles
	wing blood components ha	s an important role	in healing a superfic
wound ?			
wound ?			1
wound?			
wound?			

The opposite figure shows a blood sample under the microscope, which of the following describes the labelled figures?

	Plasma	Platelet	White blood cell	Red blood cell
L, &	P	Q	R	S
~	Q	P	S	R
	R	S	Q	P
!	S	R	P	Q

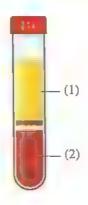


- - transport of oxygen from the two lungs to the heart.
 - occurrence of coagulation, on exposure to blood bleeding.
 - c production of antibodies.
 - d attacking of microbes.



The opposite figure illustrates the separation of blood sample components of a normal person by using centrifugation, which of the following represents the blood components in no. (1) and (2) respectively?

	(1)	(2)
	Red and white blood corpuscles.	Plasma and blood platelets.
Ь	White blood corpuscles and blood platelets.	Red blood corpuscles and plasma.
-	Plasma	Red and white blood corpuscles and blood platelets.
	Blood platelets.	Red and white blood corpuscles and plasma.



- All the following have an immunization role in the human body, except the
 - (a) red blood corpuscies.

(b) white blood corpuscles.

© blood platelets.

- d blood plasma.
- Which of the following organs shares in the formation of about 46% of the blood?
 - a Liver.
- Bone marrow.
- © Spleen.
- d Lymphatic system.
- The factors of blood clotting are activated in the presence of
 - a blood platelets.

b teared blood vessels and cells.

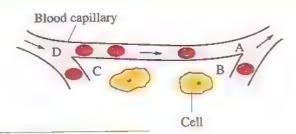
c fibrinogen.

- d prothrombin.
- Which of the following presents in the plasma during the absence of blood clotting factors from a blood sample?
 - a Thromboplastin.
- (b) Thrombin.
- © Fibrin.
- d Fibrinogen.
- Haemophilic patient is advised to eat food containing
 - a lipids.
- b carbohydrates.
- © vitamin K
- d vitamin A
- The increase in percentage of some types of lipids in blood, represents a risk of forming clots inside the blood vessels, because they
 - a increase the speed of blood inside the vessel.
 - b prevent the secretion of heparin substance.
 - c stimulate the conversion of fibrin into fibrinogen.
 - d obstruct the movement of blood in normal manner.

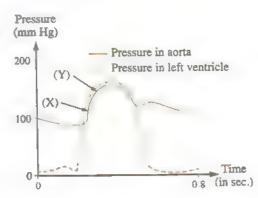
3		wing doesn't agree wit	h delaying the bleedi	ng stop, when	
	a simple cut occurr	red in a blood vessel ne	ear to the skin surface	?	
a Shortage of vitamin Kb Shortage of calcium ions in blood.					
	Malformation of	of thrombin substance i	n its specific time.		
	Breaking down	of blood platelets insi-	de the blood vessel.		
37	Which of the follow	wing substances are see	creted by liver in the	blood ?	
	Fibrin and hepa	rin.	b Prothrombin and thromboplast		
	© Prothrombin an	d heparin.	and the second s	fibrinogen.	
38	The following g	graphs represent the an	Ount of vitamine and	I minorale in face for 1	
	substances:	, I	Nation of vitalining and	numerals in four food	
	Vitamin C mg/100g	Vitamin D mg/100g	Iron mg/100g	Calcium mg/100g	
	30-	15-	3-	150	
	20-	10-	2-	100-	
	10-	5 -	1-	50-	
	0 = 8 = 8	0	0	. 0	
	Bean Eggs Fish Fruits	Bean Eggs Fish Fruits	Bean Eggs Fish Fruits	Bean Eggs Fish Fruits	
	(1) Which of the for	llowing food substance	es is considered the b	est source for transporting	
	a Bean.	b Eggs.	© Fish.	(d) Fruits.	
	(2) The most food s the blood from b	substance rich in an ele	ment which is necess	sary for protecting	
	a fruits.	b fish.	© eggs.	d bean.	
39	pressures ?	figure, which of the fo	llowing blood vessel	s carry blood at low	
	(1) & (2).	Blood capillaries	(2)	(3)	
	f (1) & (4).	of the	Heart	Blood capillaries of the	
	© (2) & (3).	lungs	7	rest of the body	
	<u>(d)</u> (2) & (4).		(1)	(4)	
40	The blood pressure i	is maximum in the	##AAAAA		
	a veins of left arm.		b arteries of r	ight arm	
	c renal arteries.		d artery of lef		
			اساسی)/۳۵ (م: ۱۸)	137 العجاجية لغات (الكتاب الا	



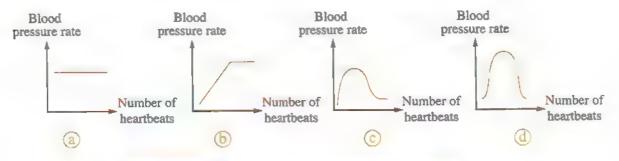
- In the opposite figure, at which point the blood pressure is maximum?
 - (A).
- (b) (B).
- (C).
- (d) (D).



- The opposite graph illustrates the change in blood pressure in aorta and left ventricle, during a complete beat of the heart. Which of the following causes the increase of blood pressure between the points (X) and (Y)?
 - (a) The contraction of left atrium.
 - b The relaxation of left atrium.
 - © The contraction of left ventricle.
 - d The relaxation of left ventricle.



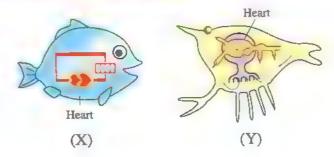
Which of the following graphs illustrates the relation between the rate of blood pressure and number of heartbeats, after waking up from sleeping?



Second

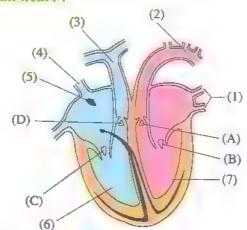
Miscellaneous Questions

The opposite figures illustrate the circulatory system in two species of animals (X) and (Y). Which one of them resembles the circulatory system of human? Explain your answer.

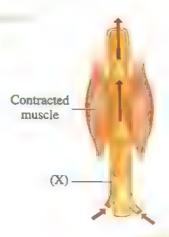


- "The human body contains a group of internal membranes that differ in their function"

 Illustrate this using two different examples.
- The human heart contains valves with specific fixed function". How far this statement is correct? With explanation.
- What happens in case of: the absence of valves from the heart muscle?
- 5 Choose the anomalous word, then mention what links the rest:
 Joy state / Grief state / Vigorous exercises / Waking up.
- What happens in case of: the absence of sino-atrial node?
- 7 The opposite figure shows a diagram for the human heart:
 - (a) Mention the names of each of the valves (A), (B), (C) and (D).
 - (b) What is the type of blood that presents in the structures from no. (1): (4) "oxygenated or deoxygenated", "under low pressure or high pressure"?
 - (c) Mention the difference between the structures no. (6) and (7)?
 - (d) Describe how the structure no. (5) can be stimulated to increases the rate of heartbeats.



- 8 What is the relation between : the heart valves and heartbeats?
- Explain: the contraction of two ventricles comes after the contraction of two atria.
- Give reason: the presence of arteries usually buried among the body muscles.
- Give reason: the wall of artery is thicker than the wall of vein.
- 12 The opposite figure illustrates the blood flow in a human leg during walking:
 - (a) What does the label (X) represent? Mention two reasons for your answer.
 - (b) Illustrate the blood flow, when the two muscles contract.
 - (c) How does the contraction of two muscles affect the rate of heartbeats ? Explain your answer.
 - (d) What are the factors upon which the blood flow in this direction depends?





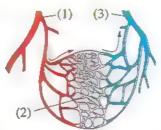
- Give reason: the bleeding from artery is more dangerous than bleeding from vein.
- Choose the anomalous word, then mention what links the rest:

 Aorta artery / Pulmonary artery / Pulmonary vein / Hepatic artery.
- 15 The opposite figures represent two types of blood vessels:
 - (a) What is the type of vessel (X) and vessel (Y)?
 - (b) In which layer do the elastic fibers present? And in which vessel is their presence rare?





- Give reason: although the blood pressure is low in veins, blood returns back to the heart through them.
- What is the difference between: pulmonary vein and pulmonary artery?
- What happens in case of: the absence of valves from the inside of some veins cavity?
- The opposite figure represents one of the blood vessels networks in the body:
 - (a) What is the functional suitability of structure no. (2)?
 - (b) Where does the structure no. (2) present in the human body?
 - (c) Which of these structures contains:
 - 1. The highest percentage of oxygen.
 - 2. Valves that control the passage of blood.
 - (d) What is the value of blood pressure in the structure no. (2)?



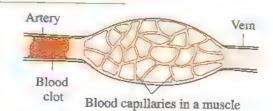
- "The presence of valves is restricted on one type of blood vessels only, that are connected with the heart". How far this statement is correct? With explanation.
- 21 What is the similarity between: root hairs and blood capillaries?
- "Water represents the largest percentage in the structure of human's blood".

 How far this statement is correct? With explanation.
- What happens in case of: the shortage in percentage of haemoglobin that presents in the red blood corpuscles than the normal range?

- Choose the anomalous word, then mention what links the rest:

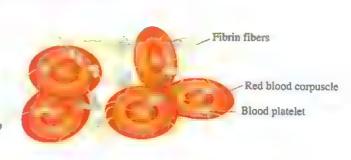
 Oxygen / Haemoglobin / Carbo-aminohaemoglobin / Oxyhaemoglobin.
- What happens in case ot: the shortage of iron element in the human food?
- The number of red blood corpuscles increases in the people who live in higher altitudes". How far this statement is correct? With explanation.
- "The role of prothrombin differs from the fibrinogen, when human exposed to a wound".

 Explain this.
- "Liver has two contrasting functions related to the blood clotting". Explain this.
- What is the relation between: the blood clotting and vitamin (K)?
- The opposite figure illustrates the formation of a blood clot inside an artery of a muscle, suggest the name of one substance that is useful and doesn't reach the blood capillaries in the muscle.



- Explain: the nature of fibrin protein suits its function.
- Explain: fibrin filaments play an important role in maintaining the human's life.
- What is the relation between: liver and formation of blood clot?
- The following figure shows a blood clot in a cut blood vessel:
 - (a) Mention the role of fibrin fibers in the formation of blood clot.
 - (b) Suggest two functions for the blood clot.
 - (c) What are the most important enzymes needed to form the clot?

 And what is their role?



- "In the normal case, blood contains a varied group of soluble and insoluble proteins".

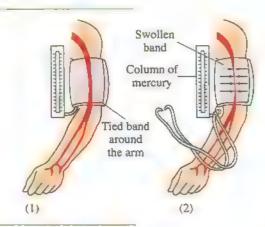
 How far this statement is correct? With explanation.
- Explain: the liver fibrosis patient may suffer from haemophilia.



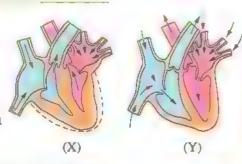
- 🛂 💸 Explain: we shouldn't eat many fatty food.
- Choose the anomalous word, then mention what links the rest:
 Thrombin / Fibrinogen / Thromboplastin / Heparin.
- The two opposite figures illustrate the mechanism of measuring the blood pressure in human:

 Which of them represents the systolic blood pressure? And which of them represents the diastolic blood pressure?

Giving reason.



- "The maximum blood pressure is in the veins that are close to the heart, during the relaxation of ventricles". How far this statement is correct? With explanation.
- 41 From the two opposite figures :
 - (a) Which of the two figures (X) or (Y) represents the maximum value of blood pressure, and which of them represents the minimum value?
 - (b) What is the sound produced by the heart in each of the two figures?



42 ♥ In the opposite figure :

- (a) What do you expect to happen at each of the two points (X) and (Y)?
- (b) Explain the reason for decreasing the blood pressure, during the coming out of blood from the heart, till reaching the blood capillaries.
- (c) Explain the necessary for blood to pass very slowly in the blood capillaries.
- Blood pressure
 (mm Hg)

 W

 Heart

 Blood
 capillaries
- (d) Why is the blood pressure in blood capillaries equal to (10 mm Hg)?
- Explain: the human blood pressure decreases in case of the occurrence of bleeding.



Blood circulation

- Blood circulation in man can be divided into three main pathways which are:
 - Pulmonary circulation.
- Systemic circulation.
- Hepatic portal circulation.

1 Pulmonary circulation



- It starts from the right ventricle and ends in the left atrium, and it takes place as follows:
 - When the right ventricle contracts, the tricuspid valve closes the opening of right atrium.
 - ② The deoxygenated blood rushes through the pulmonary artery and the pulmonary (semi-lunar) valve prevents the backflow of blood to the right ventricle.
 - The pulmonary artery gives rise to two branches (a branch in each lung), where each branch of them branches in its tissues to form several arterioles which end with blood capillaries spread around the alveoli.
 - O The exchange of gases takes place, where carbon dioxide gas and water vapour will diffuse from the blood, and oxygen gas will move towards the blood. So, the blood becomes oxygenated.
 - The oxygenated blood returns from the two lungs through four pulmonary veins (two veins from each lung) to open into the left atrium.



• At the end of the pulmonary circulation, the walls of left atrium contract, pushing the blood to the left ventricle and the bicuspid valve prevents the backflow of blood to the left atrium.



Test yourself

Choose the correct answer:

The relaxation of right ventricle is synchronized with

- (a) the closure of mitral valve.
- (b) the opening of mitral valve.
- (c) the closure of tricuspid valve.
- (d) the opening of pulmonary valve.

Systemic circulation

- It starts from the left ventricle and ends in the right atrium, and it takes place as follows:
 - The left ventricle contracts after being filled with the oxygenated blood, so that the bicuspid (mitral) valve closes the opening of left atrium.
 - Blood will rush to the aorta, and the aortic (semi-lunar) valve prevents the backflow of blood to the left ventricle.
 - Aorta gives rise to several arteries, where some of them move upward of the body, while the others go downward. Arteries then branch to form smaller and smaller arterioles which end by the blood capillaries spread through the tissues in between the cells, transporting oxygen, water and dissolved food substances from blood to them.
 - O Products of catabolism, such as corbon dioxide gas (resulting from the oxidation of fats and sugar) diffuse through the walls of blood capillaries and reach the blood, changing its colour from the light red to dark red (deoxygenated blood).
 - O Blood capillaries gather to give rise to a larger and larger blood vessels which are "veins".
 - O Veins pour the deoxygenated blood into the superior and inferior venae cavae which pour the blood into the right atrium.



• At the end of the systemic circulation, the walls of right atrium contract (when it is filled with blood), pushing the deoxygenated blood to the right ventricle and the tricuspid valve prevents the return back of blood to the right atrium.

Note

The contraction of right side of the heart occurs at the same time of the left side contraction. Therefore, the pumping of deoxygenated blood from the right ventricle and the pumping of the oxygenated blood from the left ventricle, take place at the same time

Test yourself

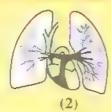
Choose the correct answer:

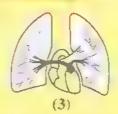
All the following blood vessels are connected with the right side of the heart, except the

- (a) superior vena cava.
- (c) pulmonary vein.

- (b) inferior vena cava.
- d) pulmonary artery.
- Arrange the following stages correctly, if the blood circulation starts with the return of oxygenated blood from the two lungs:



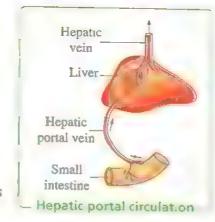






Hepatic portal circulation

- It starts from the blood capillaries of the small intestine villi and ends by the blood capillaries inside the liver, and it takes place as follows:
 - 1 Small intestine's villi absorb glucose and amino acids which are transported to the blood capillaries present inside the villi.
 - These blood capillaries aggregate into larger and larger veins, and finally they pour their contents into the hepatic portal vein which is connected with veins from the spleen, pancreas and stomach.

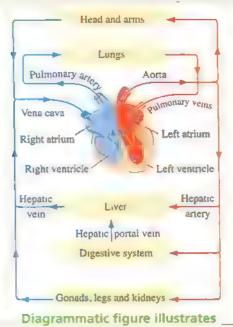


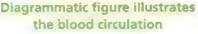
- The hepatic portal vein branches into venules (when it enters the liver) which end with minute blood capillaries, through their walls the excess food substances which exceed the body needs are filtered and passed to the liver where they undergo certain changes.
- The blood capillaries gather to form the hepatic vein which leaves the liver and pours its contents into the upper part of inferior vena cava which pours the blood in the right atrium.

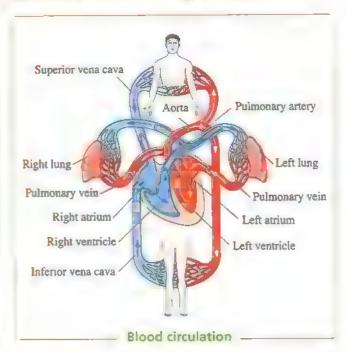




We can summarize the blood circulation in the following two diagrams:







Test yourself -

Choose the correct answer:

- (1) Which of the following pathways illustrates the transfer of a glucose molecule from the small intestine, till it reaches the heart?........
 - (a) Small intestine Hepatic vein Liver - Hepatic portal vein Superior vena cava.
 - (b) Small intestine Hepatic portal vein Liver Hepatic vein Superior vena cava.
 - © Small intestine Hepatic vein Liver Hepatic portal vein Inferior vena cava.
 - d Small intestine Hepatic portal vein Liver Hepatic vein Inferior vena cava.
- (2) The organ that receives blood from two main blood vessels, then the blood comes out from it in one blood vessel is the
 - a heart.
- (b) liver.
- © kidney.
- (d) two lungs.

For illustration only

There is a fourth blood circulation that is called the cardiac circulation which includes the movement or flow of blood inside the four chambers of heart, according to the contraction and relaxation of the heart chambers.



Lymphatic system

- The lymphatic system is considered the immune system of the body, due to its defensive ability, where it produces the antibodies that are responsible for acquiring the body its immunity.
- The spleen is considered one of the most important lymphatic organs in the body.
- The lymphatic system consists of :

1 Lymph:

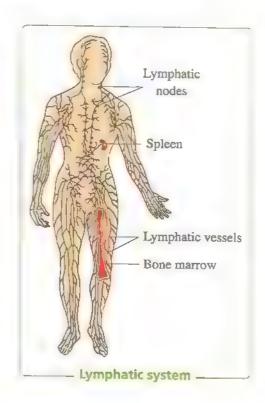
- It is a fluid that filtered from the blood plasma during its passage through the blood capillaries.
- It contains nearly most of the plasma constituents, in addition to a large number of leucocytes (WBCs).

② Lymphatic capillaries (vessels):

They work on collecting the lymph to return it into the circulatory system through the superior vena cava.

C Lymphatic nodes :

- They are sieves (filters) that found at certain points along the lymphatic vessels through which the lymph passes.
- They trap and destroy the microbes by the white blood cells produced by them.





Choose the correct answer:

- (1) All the following are from the components of lymph, except the
 - (a) amino acids.
- (b) antibodies.
- (c) prothrombin.
- (d) sodium salts.
- (2) Which of the heart's chambers is responsible for receiving the lymph?.......
 - (a) Right atrium.
- (b) Right ventricle. (c) Left atrium.
- (d) Left ventricle.



Continue: Human Transport System

(Blood Circulation and Lymphatic System)



The questions signed by 🎺 measure the high levels of thinking.

Interactive Test

	0	Multiple Ch	oice Questions			
	left ventricle – ri	can be arranged from the taght ventricle – two atria. entricle – right ventricle.	gright ventricle – left	t ventricle – two atria.		
	Which of the followers on?	lowing is considered the fi	Left ventricle.	cine in a smoking Right ventricle.		
8	a Left ventricle — b Left ventricle — c Right ventricle –	lowing represents the path cidney?	enal vein.	puscle from		
	The blood that reach left atrium.	hes the brain cells, leaves to bright atrium.	the heart from the · · · · · · · · · · · · · · · · · · ·			
3	The blood vesse CO ₂ is	l in which blood passes ur b pulmonary artery		ontains high level of d renal artery.		
3	Which of the follow Mitral valve.	ing valves allows the pass		h pressure? Bicuspid valve.		
8	Which of the following describes the aortic valve and mitral valve, when the left ventricle is relaxing?					
		Aortic valve	Mitral valve			
		Closed	Closed			
	(b)	Closed	Opened			
	©	Opened	Closed			
	a	Opened	Opened			

The two valves that allow the passage of blood at the same time are bicuspid and pulmonary valves. pulmonary and aortic valves. tricuspid and aortic valves. tricuspid and pulmonary valves. Which of the following disagrees with the contraction of two ventricles?.............. (a) The passage of blood through the aortic valve. b The closure of mitral valve. C The closure of tricuspid valve. d The closure of pulmonary valve. 10 💸 Which of the following valves determine the pathway of oxygenated blood through the heart? Bicuspid and tricuspid valves. (b) Bicuspid and aortic valves. Pulmonary and aortic valves. Tricuspid and pulmonary valves. The opposite diagram shows the circulatory system of a mammal: Which of the following describes the blood in vessels (X) Capillary and (Y)? ----in the lungs -(X)(X) (Y) Right Left atrium atrium (a) Deoxygenated Deoxygenated Right Left ventricle (b) Deoxygenated ventricle Oxygenated (0) Oxygenated Deoxygenated (d) Oxygenated Capillary Oxygenated network in the body organs D The opposite diagram shows the circulatory system of a mammal: Head and fore-limbs What does the part (X) represent? (a) Heart. (b) Kidneys. Keys: C Liver. Oxygenated blood d Lungs. Deoxygenated blood Lower body and hind limbs



18 The number of major blood vessels that carry oxygenated blood and come out of the heart is

(a) I

(b) 2

(c) 3

(d) 4

- Which of the following statements is correct?
 - The right ventricle is filled with blood before the left ventricle. The left ventricle is filled with blood before the right ventricle.
 - (c) The left atrium is filled before the right atrium.
 - (1) The two ventricles are filled with blood at the same time.
- IS On the arrival of blood to the heart through the venae cavae, through which of the following blood vessels will the blood pass after that?

(a) Pulmonary vein.

(b) Pulmonary artery.

C Hepatic vein.

(d) Hepatic portal vein.

The highest value of blood pressure is in the

a pulmonary artery.

(b) superior vena cava.

c aorta artery.

d inferior vena cava.

17 The following figures illustrate four different stages during a heartbeat:



(X)



(Y)



(Z)



(L)

Which of the following represents the correct arrangement of stages that occur after the stage (Y)?

(1) $(X) \longrightarrow (L) \longrightarrow (Z).$

(b) $(L) \longrightarrow (X) \longrightarrow (Z).$

 \bigcirc (L) \longrightarrow (Z) \longrightarrow (X).

- (1) $(Z) \longrightarrow (L) \longrightarrow (X)$.
- Which of the following occur when the blood passes from the right ventricle to the two lungs?
 - (a) The closure of mitral valve and the opening of tricuspid valve.
 - (b) The opening of mitral valve and the closure of tricuspid valve. The opening of pulmonary valve and the closure of tricuspid valve. The closure of pulmonary valve and the opening of tricuspid valve.

19 In the opposite figure:

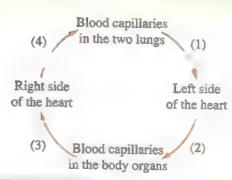
Which of the following blood vessels contain the highest percentage of oxygen gas?

(a) (1) & (2).

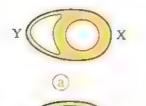
(b) (2) & (3).

© (3) & (4).

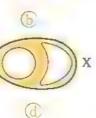
(1) & (4).

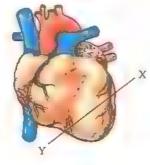


Which of the following figures illustrates a section in the heart at the two points (X) and (Y)?





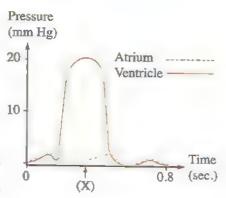




The opposite graph shows the changes that occur in each of the left atrium and left ventricle during the heartbeats:

Which of the following represents the state of valves at time (X)?

- a) The closure of each of the mitral and aortic valves.
- (b) The closure of mitral valve and opening of aortic valve.
- © The opening of mitral valve and closure of aortic valve.
- d The opening of each of the mitral and aortic valves.



- Which of the following expresses the pathway of a red blood cell from the foot, till reaching the arm?
 - (a) Foot → Two lungs → Heart → Alimentary canal → Arm.
 - b Foot → Heart → Two lungs → Kidney → Arm.
 - © Foot → Kidney → Heart → Two lungs → Arm.
 - Foot → Heart → Two lungs → Heart → Arm.



23 🎺 In the opposite figure :

Which of the following pathways shows the transfer of blood from the two lungs to the heart, then its pumping to the body parts and its return back to the heart again?



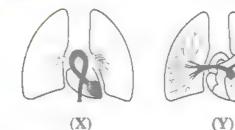
$$(a) X \longrightarrow Z \longrightarrow L \longrightarrow Y$$

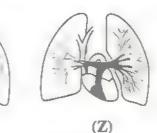
$$\bigcirc X \longrightarrow Z \longrightarrow Y \longrightarrow L$$

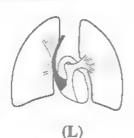
$$\bigcirc Y \longrightarrow L \longrightarrow X \longrightarrow Z$$

$$(d) Y \longrightarrow L \longrightarrow Z \longrightarrow X$$









(1) If the blood circulation starts with return of deoxygenated blood from all the body parts, which of the following represents the correct pathway for that?

$$(a)(X) \longrightarrow (Y) \longrightarrow (Z) \longrightarrow (L).$$

$$(b)(Y) \longrightarrow (Z) \longrightarrow (L) \longrightarrow (X).$$

$$\bigcirc$$
 (L) \longrightarrow (Z) \longrightarrow (Y) \longrightarrow (X).

$$(1)$$
 (2) \longrightarrow (Y) \longrightarrow (L) \longrightarrow (X) .

(2) The strongest stage of heart pumping for blood is the stage

- (X).
- **(b)** (Y).
- **(**Z).



(X)

25 From the opposite figure:

(1) Which of the following represents the function of structure (X)?

Transporting the oxygenated blood from the heart to all the body parts.

Transporting the oxygenated blood from the two lungs to the heart.

Transporting the deoxygenated blood from the heart to the two lungs.

Returning the deoxygenated blood from all the body parts to the heart.

- (2) Which of the following vessels is connected with the heart, but it is not seen in the figure?
 - a Aorta.

(b) Superior vena cava.

© Pulmonary artery.

d Inferior vena cava.



- a pancreas.
- **b** spleen.
- c stomach.
- d kidneys.

From the opposite figure:

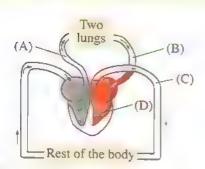
Which part carries the oxygenated blood at low pressure?

(A).

(b) (B).

© (C).

(d) (D).



The opposite table shows some changes happen in the blood components' concentration during its passage through an organ, from which of the following organs does this blood come out?

Blood components	The change in concentration
CO ₂	Increases
Glucose	Increases
02	Decreases
Amino acids	Increases

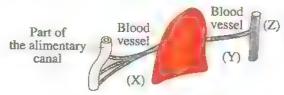
- a Brain.
- (b) Kidney.
- © Small intestine.
- d Liver.
- 29 In the opposite figure:
 - (1) Which of the following is transported in the blood vessel (X)?

Glucose.

Bile juice.

© Glycogen.

d Urea.



(2) The blood that flows in the blood vessel (Y) contains a high level of

a haemoglobin.

c oxyhaemoglobin.

- (b) carbo-aminohaemoglobin.
- d fatty acids.
- (3) The blood vessel (Z) represents the

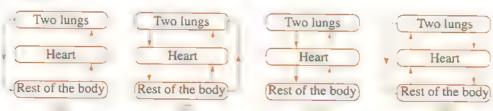
upper part of superior vena cava.

upper part of inferior vena cava.

lower part of superior vena cava.

lower part of inferior vena cava.

Which of the following diagrams illustrates the blood circulation in the human body? ...





- 31 In the opposite figure:
 - (1) Through which of the following pathways the blood must pass to transfer from the blood vessel no. (6) to the blood vessel no. (5)?

$$\bigcirc$$
 (6) \longrightarrow (4) \longrightarrow (3) \longrightarrow (5).

$$\bigcirc$$
 (6) \longrightarrow (7) \longrightarrow (8) \longrightarrow (5).

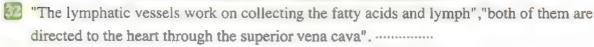
(2) Which of the following organs is/are connected with three blood vessels?

Two lungs.

b Liver.

© Small intestine.

Two kidneys.



The first statement is wrong, while the second statement is correct.

The first statement is correct, while the second statement is wrong.

- The two statements are correct.
- d The two statements are wrong.
- Which of the following organs has a great importance for the circulatory and lymphatic systems together?

(a) Liver.

- (b) Pancreas.
- © Bone marrow.
- d Lymphatic node.

Two lungs

Two kidneys

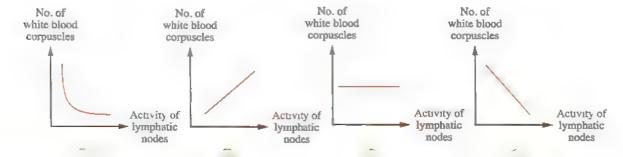
(3)

Small intestine

Liver

(1)

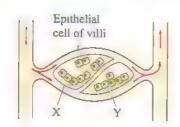
Which of the following graphs illustrates the relation between the activity of lymphatic nodes and the number of white blood corpuscles, during the infection with influenza virus?



35 From the opposite figure:

Which of the following is correct? ...

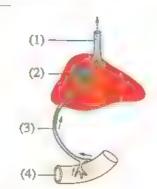
	(X)	(Y)
a	Amino acids	Glucose
Б	02	Fatty acids
	CO ₂	Glucose
a	02	CO ₂



Second | Miscellaneous Questions

- Give reason: the wall of ventricle is thicker than the wall of atrium.
- 2 Explain: the blood pressure is different in each of the aorta and pulmonary artery, although both of them are arteries.
- 3 Compare between: the bicuspid valve and tricuspid valve.
- Give reason: the wall of left ventricle is thicker than the wall of right ventricle.
- The blood vessel that contains the highest level of glucose is the hepatic vein.

 How far this statement is correct? With explanation.
- 6 VLiver is called the gate of food in the body. Explain.
- 7 Follow by arrows only: the pathway of a red blood cell that presents in the blood accompanied by the absorbed digested food, till reaching the right atrium of heart.
- 8 From the opposite figure:
 - (a) What would happen to the excess food substances when they pass through the structure no. (2)?
 - (b) Determine three organs whose veins pour their contents in the structure no. (3).
 - (c) After eating a meal, which blood vessel will contain the highest concentration of sugar?



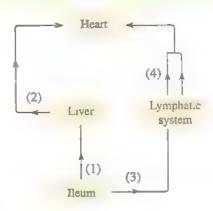
Follow by arrows only: the pathway of a glucose molecule, since its passing from the intestine, till reaching the foot.



In the opposite figure :

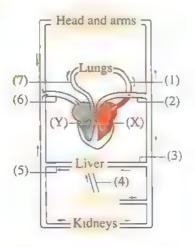
- (a) What is the name of the pathway
 (1) → (2)? And what are the digested substances that pass through it?
- (b) What is the name of the pathway (3) (4)?

 And what are the digested substances that pass through it?
- (c) Which of the two blood vessels (1) or (2) contains the greatest amount of digested food during the food absorption process?
- (d) What are the final blood vessels into which the two vessels no. (2) and (4) pour the fluid that presents in them?

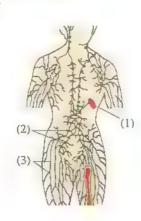


Study the opposite figure, then answer the following:

- (a) Mention the number of blood vessel that:
 - 1. Connected with the blood vessels of pancreas, spleen and stomach.
 - 2. Carries the highest level of oxyhaemoglobin.
 - 3. Contains the highest level of amino acids, after eating a meal.
- (b) Which of them (X) or (Y) contains the bicuspid valve?
- (c) What is the side of heart that contains oxygenated blood (X) or (Y)?
- (d) Mention the type of blood in the two blood vessels no. (2) and (7).



- What happens in case of: the absence of lymphatic nodes that present along the lymphatic vessels?
- Spleen has a great importance for the circulatory and lymphatic systems. Explain.
- The opposite figure represents the most important defensive systems in the human body:
 - (a) What would happen in case of the removal of structure no. (1)?
 - (b) Illustrate the relation between the structure no. (2) and the number of white blood corpuscies, on the exposure to an infection.
 - (c) What is the difference between the fluid that presents in the structure no. (3) and blood plasma?



Transport in Living Organisms



Choose the correct answer (1:21):

- In the opposite figure, what will happen during this stage?
 - (a) The bicuspid valve will close.
 - b The semi-lunar valves will open.
 - © The ventricles will relax.
 - d The ventricles will contract.



- From the opposite figure, when a disturbance occurs in the structure (X), the blood returns back again to the
 - a right atrium.

b left atrium.

c right ventricle.

d left ventricle.



- Which of the following doesn't agree with the characteristics of the inferior vena cava ?

 - 1 It carries the blood at low pressure. 1 It carries the blood to the heart.
 - © It carries deoxygenated blood.
- d Its wall is thick.
- Chlamydomonas alga shares Amoeba in that each of them
 - a contains specialized transport tissues.
 - b transfers gases to it from the surrounding medium by diffusion.
 - transfers the absorbed food substances by active transport through it.
 - transfers the absorbed food substances and gases through it by diffusion and active transport.



The following diagram represents a step in the formation of blood clot:

Damaged cells
Blood platelets
Blood clotting factors

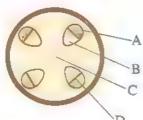
Process (Y)

Prothrombin

Which of the following accelerates the process (Y)?

- . Thrombin.
- (b) Heparin.
- © Fibrin.
- d Vitamin (K).

The opposite figure illustrates
a diagrammatic section in the stem
of a dicot plant, examine it, then
answer:



The tissue that participates with an indirect method in increasing the efficiency of transport process in the plant, is

(a) A

(b) B

- © C
- (d) D

The tissue that contributes in supporting the plant, is

a A

b B

© C

d D

Which of the following tissues doesn't contain parenchyma cells?

(a) A

(b) B

- © C
- **d** D

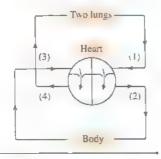
From the opposite figure, the highest rate of blood pressure is found in the blood vessel no.

a (1).

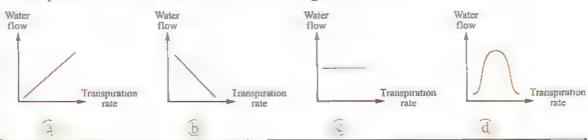
(b) (2).

© (3).

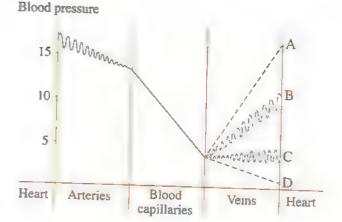
(4).



Which of the following graphs illustrates the relation between the rate of transpiration and water flow in the stem through 24 hours?



The opposite graph shows the blood pressure of a person at rest, where blood comes out from the heart and passes through arteries to the blood capillaries. Which of the following illustrates the blood pressure during its passage in the veins, before its returning back to the heart?



(A).

(b) (B).

© (C).

(D).

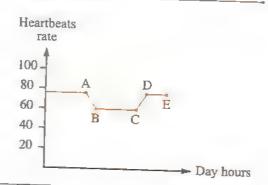
Study the opposite graph which shows the rate of heartbeats of "Ali" during the day, then determine the phase that represents the time of sleeping

(a) CD

(b) AB

© BC

d DE



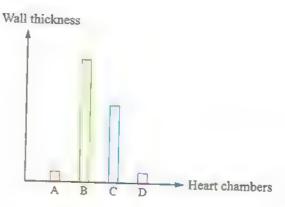
Study the opposite graph which expresses the difference in the thickness of muscular fibers which form the human heart chambers, then determine which column represent the right ventricle

. (A).

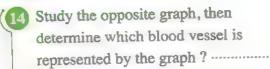
(b) (B).

© (C).

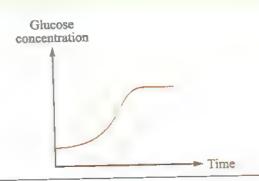
(D).



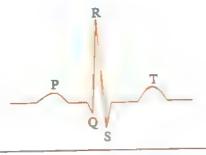




- a Hepatic vein.
- **b** Pulmonary artery.
- © Hepatic portal vein. (d) Hepatic artery.

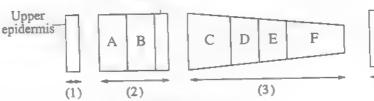


- The opposite figure shows the normal electrical impulses for the human heart during a heartbeat, which of the following shows the pathway of nerve impulse from the two atria till the contraction of ventricles' walls?
 - (a) P & R
- (b) T & P
- (c) R & Q
- (d) Q & S



Study the following diagram which shows 4 parts in the structure of a dicot plant's stem, arranged from outside to inside, then answer the following:

Starch sheath



d 130

What is the function of (B) and (W) tissues?

- (a) Transporting inorganic substances.
- **b** Elasticity and support.
- © Aereation and storage.
- d Transporting organic substances.



W

(4)

© 80

increases, which phenomer	ignin increases in the xylem vessels, the ascent of sap
•	on represents this relation?
a Cohesion force.	b Adhesion force.
© Capillarity phenomenon	d Osmotic pressure.
Which of the following tran	asfers prothrombin to its activation site ?
a Blood platelets.	(b) WBCs
© Plasma.	(d) RBCs
The pH value of the blood	= 7.4, due to the presence of salts.
a Na ⁺	ⓑ Cl⁻
g HCO ₃	J Ca ²⁺
	d transporting ready made food increases.
What happens if: the conc	(22:27): entration of dissolved ions in the root cells is equal to their
What happens if: the concentration in the soil solu	(22:27):

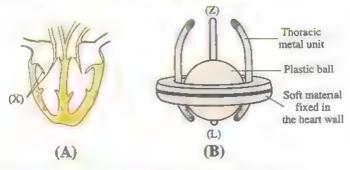




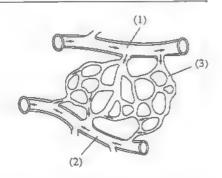
What is the similarity between : pericycle and medullary rays?



The till—and figure A represents a longitudinal section in the heart muscle, when a lamage occurred in part X it is replaced by an artificial part represented in figure (B), examine the two figures, then answer:



- (a) What does the figure (B) represent? And what is its role?
- (b) Determine the direction of each of (Z) & (L) when fixing this part in the heart.
- The opposite figure represents the movement of blood inside the blood vessels, examine it, then answer:
 - (a) What is the difference between the blood components in each of the blood vessel no. (1) and no. (2)?



(b) Determine the direction of the blood flow in each of the blood vessel no. (1) and no. (2) (according to the heart).



Lesson 1 : Cellular Respiration.

Lesson 2: Respiration in Living Organisms.

Model Exam on Chapter 3

Objectives of the chapter

By the end of this chapter, the student should be able to

Identify the concept of cellular respiration.

Understand the steps of glycolysis and its importance.

Identify the steps of aerobic respiration and where it takes place.

Distinguish between the aerobic and anaerobic respiration.

Identify the role of lungs in the respiration mechanism in man.

State the importance of cellular respiration.

Link between photosynthesis and respiration in plants.





Cellular Respiration

 Before studying the cellular respiration, we must differentiate between the gas exchange and cellular respiration:

Gas exchange

The process in which the living organism obtains oxygen directly from the atmospheric air, as in case of the unicellular organisms or by a respiratory system, as in case of the multicellular organisms, and releases carbon dioxide as a final product of respiration.

Cellular respiration

The vital process by which the living organism's cells extract the energy stored in the chemical bonds of food molecules, especially sugars (glucose) that are manufactured by the plant or eaten by the animal, then this energy is stored in the form of ATP molecules to be used in performing the different activities.

Cellular respiration

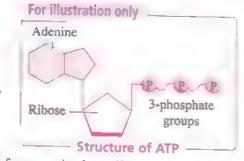
- The cellular respiration process starts by the oxidation of a glucose molecule, where the molecule of food is expressed usually by the glucose molecule, on illustrating the steps of its breaking down, as the majority of living organisms'cells use it to produce energy more than their use for any other molecules of the available food.
- Most stages of glucose molecule oxidation occur inside the mitochondria.
- The energy released from cellular respiration is stored in ATP molecules (adenosine triphosphate).

Nute

Glucose and the other carbohydrates are considered forms of stored energy, also they are forms by which the energy transfers from one cell to another and from one living organism to another.

ATP molecules

- A molecule of ATP is built up of three sub-units which are:
 - Adenine: a nitrogenous base (has basic properties).
 - Ribose: a 5-carbon (pentose) sugar.
 - 1 Three phosphate groups.
- ATP molecules are considered the universal currency of energy in the cell, as any energy required by the cell needs the presence of ATP molecules which are easily transferred, and when they change into ADP (adenosine diphosphate) molecules, an energy is released from them, where the change of ATP to ADP releases an amount of energy (which is about 7–12 kcal/mole).





Test yourself

Explain: ATP molecules are considered fast sources to obtain energy.

Phin i

Aerobic cellular respiration



- It is the main route for obtaining energy in the majority of living organisms, and it takes place in the presence of oxygen.
- \bullet The oxidation of one mole of glucose ($C_6H_{12}O_6$) produces an amount of energy that is about 38ATP, and this can be illustrated by the following equation:

$$C_6H_{12}O_6 + 6O_2 \xrightarrow{\text{Cellular}} 6CO_2 + 6H_2O + 38ATP$$

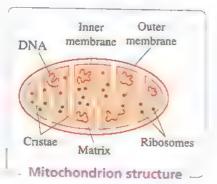
Stages of glucose molecule oxidation

- The oxidation of glucose molecule takes place in three major stages, as follows:
 - Glycolysis occurs in the cytosole (non-organelle part of cytoplasm) of the cell.
 - 2 Krebs cycle occurs inside the mitochondria.
 - Electron transport chain occurs inside the mitochondria.

 As the mitochondria contain:
 - The respiratory enzymes.
- Water.

- Coenzymes.

- Phosphate groups.
- Electron carrier molecules (Cytochromes) that carry the electrons at different energy levels, where the hydrogen atoms are removed during the reaction to be passed to the coenzymes.



CHAPTER 3

- From the most important coenzymes:
 - NAD+ which is reduced into NADH:

- FAD which is reduced into FADH2:



(hoose the correct answer: the oxidation of one molecule of glucose aerobically produces an amount of energy that equals . . . kcal/mole.

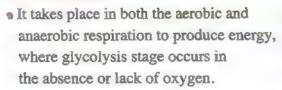
(a) 12

(b) 38

(c) 360

d) 3800

1 Glycolysis

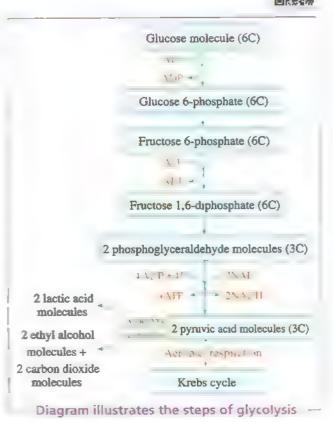


Site of its occurrence:It occurs in the cytosole.

Steps of glycolysis:

One molecule of glucose (6-carbon) is broken down into two molecules of pyruvic acid (3-carbon) through a group of reactions, as follows:

- Glucose molecule is converted into glucose 6-phosphate, then fructose 6-phosphate, then fructose 1,6-diphosphate.
- Fructose 1,6-diphosphate (6C) is broken down into two molecules of phosphoglyceraldehyde (3C).



Each molecule of phosphoglyceraldehyde (PGAL) molecule is oxidized into pyruvic acid molecule, therefore two molecules of pyruvic acid are produced.

- 9 These reactions are accompanied by : (for each molecule of glucose)
 - Reducing two molecules of the coenzyme 2NAD+ 2NADH
 - Producing two molecules of ATP in the cytosole of the cell.

The equation of reaction :

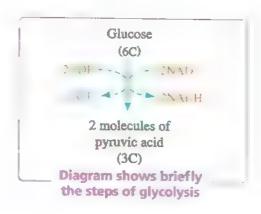
The energy produced:

Two molecules of ATP which are not enough to perform all the vital activities in the living organisms, therefore in case of the presence of oxygen, the pyruvic acid passes into the mitochondria to produce more energy, and this takes place in two stages, which are:

- Krebs cycle.
- Electron transport chain.

• The importance of glycolysis:

- The production of two molecules of ATP
- The obtaining of pyruvic acid which is used in both aerobic and anaerobic respiration.



Test yourself

1 Choose the correct answer:

- (1) In order to start the process of glycolysis, the presence of is necessary.

- (a) 2 molecules of ATP
- (b) 2 molecules of NAD+
- (c) 4 molecules of ADP
- d 4 phosphate groups
- (2) The following reaction occurs during the glycolysis, on the formation of



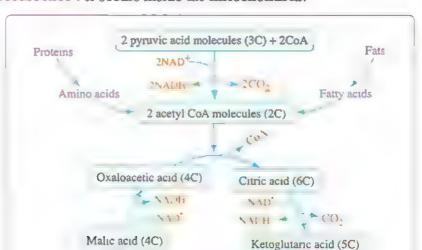
- (a) glucose 6-phosphate.
- b) fructose 6-phosphate.
- (c) phosphoglyceraldehyde.
- (d) pyruvic acid.

4	What is the relation between: the conversion of ATP into ADP and the change in
	the compounds during the glycolysis?
	HILL *** 1) *** *** */ (19*** ****) ***** ***** * * ************



2 Krebs cycle

- The first scientist who described this cycle was **Sir Hans Krebs** in 1937, and he won Nobel prize for that in 1953
- Site of its occurrence: it occurs inside the mitochondria.





Hans Krebs

Before the entry into Krebs cycle, the following occurs :

Each molecule of pyruvic acid is oxidized to change into acetyl group that combines with the coenzyme (A) "CoA", forming acetyl coenzyme (A) "Acetyl CoA", and this produces:

Succinic acid (4C)

Diagram illustrates Krebs cycle

HUL

- 2 molecules of NADH

- 2 molecules of CO,

Note

The other acetyl groups resulting from the breaking down of fatty acids and amino acids molecules can combine with the CoA to join the Krebs cycle.

- Krebs cycle steps:
 - Each molecule of acetyl CoA joins the Krebs cycle, where the CoA splits off the acetyl group to repeat its role in another cycle.
 - The acetyl group (2C) combines with the oxaloacetic acid (4C) to form citric acid (6C).
 - The citric acid passes through three intermediate compounds which start by the ketoglutaric acid (5C), then succinic acid (4C), then malic acid (4C), and at the end of reactions the citric acid is formed again (therefore Krebs cycle is called the citric acid cycle).
- During one Krebs cycle, the number of released molecules :
 - Two molecules of CO₂

- Three molecules of NADH
- One molecule of FADH,
- One molecule of ATP

- Krebs cycle is repeated twice, where once for each molecule of acetyl group, (i.e. it is repeated twice for one glucose molecule).
- The importance of Krebs cycle:

The oxidation of carbon atoms through a group of reactions by removing the electrons which are received by the coenzymes (NAD+ and FAD), and then these coenzymes transfer them to the cytochromes to release the energy required to form ATP molecules.

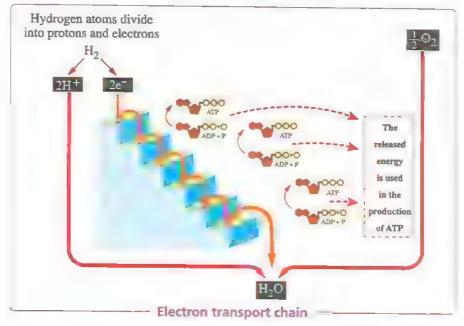
• Krebs cycle doesn't require the presence of oxygen, because the oxidation of carbon atoms during the Krebs cycle reactions occurs by losing electrons that are received by NAD+ and FAD

Test yourself

- What happens to: CO₂ molecules that result from Krebs cycle?
- Explain: the coenzyme (A) plays an important role in Krebs cycle.
- Choose the correct answer: during the formation of each of the following acids from the acid that precedes it in Krebs cycle, the reduction of coenzymes is occurred, except on the formation of acid.
 - (a) citric
- (b) ketoglutaric
- (c) malic
- (d) oxaloacetic

Electron transport chain

- The terminal (last) stage of aerobic respiration that starts with the end of Krebs cycle.
- Site of its occurrence: it occurs inside the mitochondria.





• Electron transport chain steps:

- Hydrogen and high-energy electrons that are carried on each of NADH and FADH₂ are passed through a certain sequence of coenzymes called "cytochromes" (electron carriers) that are present in the inner membrane of mitochondria.
- The cytochromes carry the electrons at different energy levels. During the passage of these high-energy electrons from one molecule of cytochrome to another, a sufficient energy is released to form ATP molecules from ADP molecules, which is called by "oxidative phosphorylation".
- A pair of electrons combines with a pair of H⁺, then with one oxygen atom to form a water molecule, according to the following equation:

$$2e^{-} + 2H^{+} + \frac{1}{2}O_{2} \longrightarrow H_{2}O$$

So, oxygen is considered the last receptor in the electron transport chain.

Note

In the electron transport chain, each NADH molecule produces three molecules of ATP, while each ${\sf FADH}_2$ molecule produces two molecules of ATP

• The importance of electron transport chain:

Releasing the energy stored in NADH and FADH₂ molecules through the passage of electrons over a sequence of cytochromes and using the produced energy to form ATP molecules from ADP molecules.

Calculation of the number of ATP molecules

- In aerobic respiration (the presence of oxygen), the oxidation of one molecule of glucose produces 38ATP molecules, where:
 - Two molecules in the cytoplasm of cell (produced during the glycolysis).
 - 36 molecules in the mitochondria (during the respiration stage).

This is illustrated in the following diagram:

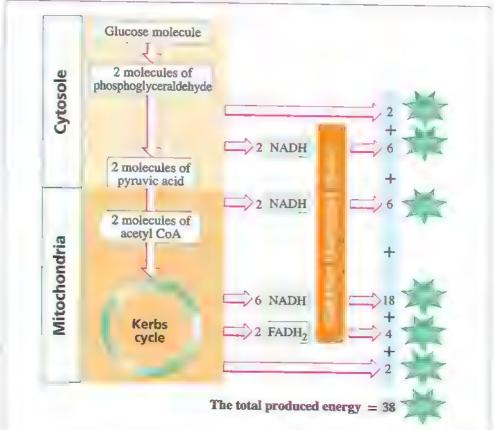


Diagram illustrates the calculation of ATP molecules

Test yourself

Choose the correct answer:

- - (a) glycolysis of a glucose molecule.
 - b occurrence of Krebs cycle twice.
 - © complete occurrence of oxidative phosphorylation process.
 - d storage of energy in NADH and FADH2 molecules.
- - a 2ATP molecules.

(b) 4ATP molecules.

© 8ATP molecules.

d 16ATP molecules.



Anaerobic cellular respiration

The anaerobic respiration (Fermentation):

Is a process by which the living organism obtains energy from the food molecule (glucose) in the absence or lack of oxygen by the help of a group of special enzymes, producing a small quantity of energy (2ATP molecules).

Stages of anaerobic respiration (Fermentation)

- Glucose molecule is decomposed into two molecules of pyruvic acid, resulting in the production of:
 - Two molecules of NADH
- Two molecules of ATP
- Pyruvic acid is converted into lactic acid or ethyl alcohol, according to the type of cell in which it was formed, and this is called "fermentation".



- Acidic fermentation: as in the animal cells (especially the muscular cells) and bacteria, where:
 - In the muscle cells, when the muscles exert vigorous efforts or exercises, they resort to the anaerobic respiration, where they consume most of the oxygen that present in them and tend to reduce the pyruvic acid into lactic acid (C₃H₆O₃) through its combination with the electrons that carried on NADH, causing what is known by the "muscular fatigue".

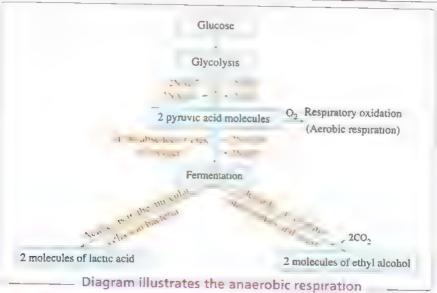
If oxygen is available, lactic acid is oxidized into pyruvic acid again, then into acetyl CoA to complete the stages of aerobic respiration and produce energy.

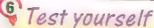
- In bacteria, the pyruvic acid is reduced into lactic acid in the absence of oxygen, and many of dairy industries depend on this type of fermentation, such as cheese, butter and yogurt.

② Alcoholic fermentation: as in yeast and some plant tissues, where pyruvic acid is reduced into ethyl alcohol (ethanol) and carbon dioxide is released. This is used in the industry of some products, such as alcohol and bread industries.

Note

Seeds of angiosperms have the ability to respire anaerobically, if they are kept in anaerobic conditions.





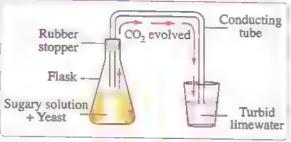
- Explain: the fermentation of pyruvic acid doesn't produce ATP molecules, although it is an important step after glycolysis, during the anaerobic respiration.
- Choose the correct answer: to remove the muscular fatigue, the muscle should be provided with a sufficient amount of
 - (a) glucose.
- b) oxygen.
- (c) glycogen.
- d glucose and oxygen.



Experiment

1. Steps:

- (1) Put a sugary solution (or molasses that is diluted with water by a ratio of 1: 2 respectively) in a conical flask.
- (2) Add a piece of yeast into the flask and mix it with the solution thoroughly.
- (3) Close the flask with a stopper of rubber through which a conducting tube passes and dip the free end of tube into a beaker containing limewater.
- (4) Leave the apparatus in a warm place for several hours.





2. Observations:

- (1) Gas bubbles are seen on the surface of solution in the flask.
- (2) The release of alcohol odour from the flask.
- (3) Limewater has become turbid.

3. Conclusion:

- (1) Yeast performs an anaerobic respiration process. So, CO₂ gas is evolved that causes the turbidity of limewater, as well as the sugary solution turns into an alcohol.
- (2) Yeast performs the anaerobic respiration (in the absence of oxygen) and this is called alcoholic fermentation.

From the previous, we can make the following comparisons:

Aerobic respiration

- It requires the presence of oxygen for the combination of electrons and protons together, then with oxygen to form water.
- Part of it occurs in the cytoplasm and the rest in the mitochondria.
- The pyruvic acid molecule is converted into a molecule of acetyl CoA
- The whole energy that present in glucose molecule is released.
- It produces high amount of energy (38ATP).
- The final products are simple substances with low-energy (H₂O and CO₂).

Anaerobic respiration

- It doesn't require the presence of oxygen, but it occurs by the help of a group of enzymes.
- All of it occur in the cytoplasm only.
- The pyruvic acid molecule is converted into either ethyl alcohol (as in yeast) or lactic acid (as in bacteria and animal muscles).
- Part of the energy that present in glucose molecule is released.
- It produces low amount of energy (2ATP).
- The final products are organic substances (ethyl alcohol or lactic acid).

2 Acidic fermentation

- It results from the reduction of pyruvic acid into lactic acid.
- It occurs in the animal cells (especially muscular cells) and bacteria.
- The acidic fermentation:
 - In muscles: causes their fatigue.
 - In bacteria: many dairy industries depend on it, such as cheese, butter and yogurt.

Alcoholic fermentation

- It results from the reduction of pyruvic acid into ethyl alcohol (ethanol) and CO₂
- It occurs in yeast and some plant tissues.
- It has many important uses in industries, such as alcohol and bread industries.

Cellular Respiration

Interactive Test

- Multiple Choice Questions In the opposite compound: (1) When the bond (X) is broken, is produced. (a) energy (b) ATP c water d carbon dioxide (Z)(2) Which part is specialized in storing energy? (a) (X). (b) (Y). (c) (Z). (d) (L). 2 ATP molecules represent the energy currency in the cell, because they are the smallest molecules of energy in the cell. (b) store the least amount of energy in the cell. c transfer the energy easily to perform the function of the cell. d can save their energy for a long period. 3 The structure of ATP molecule differs from the structure of ADP molecule in the a type of sugar. (b) type of nitrogenous base. number of phosphate groups. d number of carbon atoms.
- Which of the following compounds loses phosphate groups during glycolysis?
 - a Glucose 6-phosphate.

(b) Fructose 6-phosphate.

Fructose 1,6-diphosphate.

Phosphoglyceraldehyde.

- The actual splitting during glucose oxidation occurs to molecule.
 - a glucose

b phosphoglyceraldehyde

c fructose 1,6-diphosphate

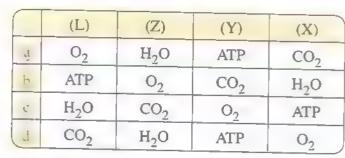
d glucose 6-phosphate

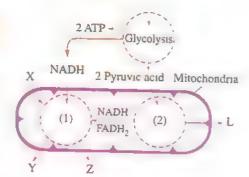
- 6 Which of the following processes is the source of energy in all the living organisms?.....
 - (a) Formation of ATP molecules in the plant cells.
 - (b) Photosynthesis in the green plants.
 - © Formation of ATP molecules in the animal cells.
 - d Formation of ATP molecules in the plant and animal cells.

a molect	ile of pyruvio	P molecules that resulte	(d) each of ATP and F	AD
a molect	ile of pyruvio		11.1	
a molect	ile of pyruvio		ea mairectly from the co	nversion of
		acid into acetyl group		
The pur		b 2	© 3	d 6
THE HUH	ber of NADI	H compounds that resul	ted from two cycles of c	- itric acid is ······
a 3		b 6	© 12	d 18
10 The fatt	y acids enter:	in the cellular respiration	on in the form of	··· molecule.
(1C)		(b) (2C)	© (3C)	(4C)
M During		4 molecules of glucose	, ATP molecule	- es will be produced
(a) 4	51,001,010 01	(b) 8	© 12	d 16
			© 72 e presence of oxygen du	
respirat	ion process p		P in the cytoplasm of the	
. 38 r	nolecules	n 36 molecules	g two molecules	one molecu
ATP	molecules ar	e produced in all the fo	llowing, except	
a Kre	os cycle.		b glycolysis.	
© ligh	t reactions in	grana.	dark reactions in	stroma.
			pic cellular respiration oc	curs through · ······
		ucose with oxygen. from glucose.		
		ucose with hydrogen.		
-	ng electrons i			

- 17 From the opposite diagram:
 - (1) which of the following is correct ?

Glucose molecule





- (2) In process (1) occurs.
- (a) coenzymes oxidation
- C CO₂ release

- **b** coenzymes reduction
- (d) O₂ release
- 18 The complete oxidation of two glucose molecules requires the occurrence of Krebs cycle for ----
 - a one time.
- b two times.
- c three times.
- d four times.
- In the equation : $(C_6H_{12}O_6 + 6O_2 6H_2O + 6CO_2)$, CO_2 gas is released.
 - a during glycolysis.
 - b during Krebs cycle only. © after glycolysis, before entering and during Krebs cycle.
 - during electron transport chain.
- The coenzyme that receives hydrogen in each of the cytosole and mitochondria is
 - (a) FAD
- (h) NAD+
- (c) CoA
- d cytochrome.
- 21 The number of electrons that are transferred by one NADH molecule to the cytochrome is
 - (a) 1

- (c) 3

- (d) 4
- 22 The number of ATP molecules that formed in the electron transport chain and resulted from the oxidation of one glucose molecule is
 - (a) 32

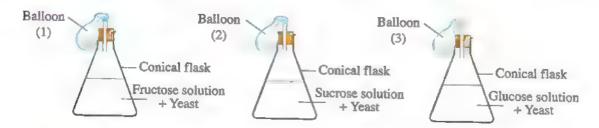
- **(b)** 34
- (c) 36

- **d** 38
- 23 During aerobic cellular respiration process, the plant produces energy in · ····
 - a mitochondria only.

- b cytosole only.
- c mitochondria and cytosole.
- d no correct answer.
- The electron transport chain is described by being
 - carrier molecules that change by changing the enzymes.
 - b the oxidative phosphorylation cycle.
 - c a sequence of oxidation and reduction reactions.
 - d an exothermic reaction.

25 N	In which of the fo	llowing stages is the lar	gest amount of ATP mole	ecules released
(directly ?			
	a Glycolysis.		6 One Krebs cycle.	
	Electron transport	chain.	d Krebs cycle and ele	ectron transport chair
26	In the absence of ATI	molecules, the	··· will not occur.	
	a glycolysis		b oxidation of pyruv	ic acid aerobically
	c electron transport	chain	d fermentation of py	ruvic acid
27	The number of ATP r	nolecules that resulted i	from the oxidation of one	e glucose molecule in
	a bacterial cell anaero			
	(a) 2	(b) 34	© 36	d 38
	© remaining of ene	energy in the formation or rgy stored in the pyruvi- rgy stored in the lactic a	c acid.	
29	c remaining of ene	rgy stored in the pyruvi	of O ₂ c acid.	obic respiration
29	c remaining of ene	rgy stored in the pyruvi	of O ₂ c acid.	obic respiration
29	c remaining of ene d remaining of ene The ratio of energy r	rgy stored in the pyruvi	of O ₂ c acid.	robic respiration (d) 19:2
29	c remaining of ene d remaining of ene The ratio of energy r is	rgy stored in the pyruvicergy stored in the lactic are leased from the aerobi	of O ₂ c acid. acid. c respiration to the anaer	<u>(d)</u> 19 : 2
29 30	© remaining of ene d remaining of ene The ratio of energy r is a 1:1 In case of the absence	rgy stored in the pyruvicergy stored in the lactic are leased from the aerobi	of O ₂ c acid. acid. c respiration to the anaer © 38:1	<u>(d)</u> 19 : 2
29	© remaining of ene d remaining of ene The ratio of energy r is a 1:1 In case of the absence	rgy stored in the pyruvice rgy stored in the lactic and released from the aerobia by 19:1	of O ₂ c acid. acid. c respiration to the anaer © 38:1	<u>(d)</u> 19 : 2
29 ³⁰	c remaining of energy rema	rgy stored in the pyruvice rgy stored in the lactic and released from the aerobic by 19:1 the or lack of oxygen, Notes electrons to the	of O ₂ c acid. acid. c respiration to the anaer © 38:1 ADH compound that resu	d 19:2 alted from the d lactic acid.
29) 30)	c remaining of energy rema	rgy stored in the pyruvice rgy stored in the lactic and released from the aerobic by 19:1 the or lack of oxygen, Notes electrons to the	of O ₂ c acid. acid. c respiration to the anaer © 38:1 ADH compound that resu	d 19:2 alted from the d lactic acid.
29 ³⁰	c remaining of ene d remaining of ene The ratio of energy r is a 1:1 In case of the absence glycolysis donates it a pyruvic acid. The substance(s) that	rgy stored in the pyruvice rgy stored in the lactic and released from the aerobic by 19:1 the or lack of oxygen, Notes electrons to the	of O ₂ c acid. acid. c respiration to the anaer © 38:1 ADH compound that result. C citric acid.	d 19:2 alted from the d lactic acid.
393031	c remaining of energy residuals and the substance of the substance of the absence of the substance of the su	released from the aerobi (b) 19:1 the or lack of oxygen, Notes electrons to the	of O ₂ c acid. acid. c respiration to the anaer © 38:1 ADH compound that result. © citric acid. the cell with energy is/are (b) proteins.	d 19:2 alted from the d lactic acid.
303132	c remaining of energy residuals and the substance of the substance of the absence of the substance of the su	released from the aerobi (b) 19:1 the or lack of oxygen, Notes electrons to the	c acid. acid. c respiration to the anaer © 38:1 ADH compound that result. © citric acid. the cell with energy is/are (a) carbohydrates.	d 19:2 alted from the d lactic acid.

From the following figures, we observe after few hours that

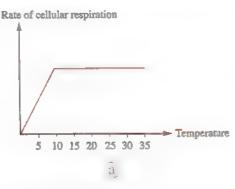


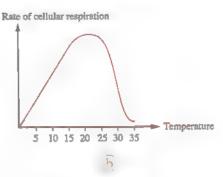
- a the volume of balloon no. (1) is greater than that of no. (2) and less than that of no. (3).
- b the volume of balloon no. (2) is greater than that of no. (1) and (3).
- c the volume of balloon no. (3) is greater than that of no. (1) and (2).
- d the volume of balloon no. (1) is greater than that of no. (2) and (3).
- In each of the alcoholic fermentation and acidic fermentation, two molecules of ATP are released, therefore it is predicted that the number of kilocalories that resulted from the breaking down of released ATP molecules
 - from alcoholic fermentation is greater than that from the acidic fermentation.
 - p from alcoholic fermentation is less than that from the acidic fermentation.
 - c is equal in both types of fermentation.
 - d there is no constant relation.
- The number of ATP molecules that resulted from the complete oxidation of one molecule of pyruvic acid is
 - (a) 6

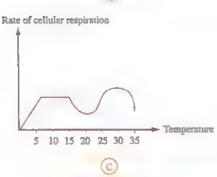
- (b) 15
- (c) 36

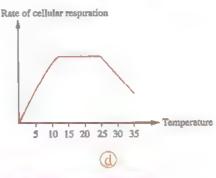
- **d** 38
- - a pyruvic acid from phosphoglyceraldehyde.
 - b succinic acid from ketoglutaric acid.
 - c malic acid from succinic acid.
 - d lactic acid from pyruvic acid.

37 In an experiment, a researcher put a primitive organism in a medium with variable temperature. Which of the following graphs expresses the relation between the temperature of medium and the rate of cellular respiration?









-

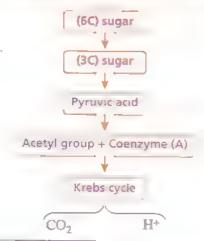
Miscellaneous Questions

- Give reason: on illustrating the mechanism of cellular respiration, food is not expressed by a molecule of fructose.
- What is the difference between: ATP and ADP?
- 3 Explain: the cellular respiration differs from the burning process.
- Give reason: ATP molecules are considered a temporary store for energy inside the cell.
- The structure of ATP molecules helps them in performing their function".

 How far this statement is correct? With explanation.
- 6 Give reason: glycolysis occurs in the aerobic and anaerobic cases of respiration.
- Calculate: the number of ATP molecules that resulted from the oxidation of three molecules of glucose in the cytoplasm.
- The cell may use protein as a source to produce energy". How far this statement is correct? With explanation.

- 9 Choose the anomalous word, then mention what links the rest: Ketoglutaric acid / Malic acid / Lactic acid / Succinic acid.
- What happens in case of: the absence of coenzyme (A) from the cells of a living organism?
- "The intermediate compounds in Krebs cycle are oxidized by adding oxygen". How far this statement is correct? With explanation.
- In the opposite figure :
 - (a) Mention the two types of carbohydrates that are stored inside the plant and animal cells.
 - (b) What is the name of the process in which (6C) sugar is converted into pyruvic acid? And where does it occur in the cell?
 - (c) What happens to the resulted hydrogen ions?

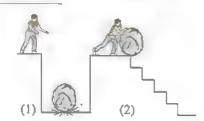




- Write the number that indicates: the number of coenzymes that resulted in one Krebs cycle.
- "When Krebs cycle is repeated for 4 times, 38 molecules of ATP are produced".

 How far this statement is correct? With explanation.
- Give reason: the formation of intermediate compounds in Krebs cycle.
- What is the difference between: NAD+ and NADP?
- Give reason: the reactions of electron transport chain don't occur in the cytosole of the cell.
- 18 In the opposite figure:

Which of the two cases represents a stage of aerobic respiration in the cell? Explain your answer.

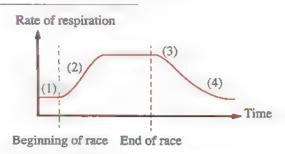


- 19 What is the similarity between: NAD+ and FAD?
- "The oxidation of 3 molecules of glucose during the electron transport chain produces 2 molecules of ATP". How far this statement is correct? With explanation.

_3

- 21 Choose the anomalous word, then mention what links the rest:

 NAD+/NADP/FAD/ATP
- How many ATP molecules are produced from the oxidation of one glucose molecule in the presence of oxygen and the absence of cytochromes from the mitochondria?
- How many reduced NAD⁺ and FAD molecules are produced from each glucose molecule that enters in the cellular respiration, when the oxygen is available?
- Explain: the shortage of oxygen doesn't affect the life of some living organisms.
- The opposite graph, illustrates the rate of respiration for a runner, during, before and after the race. At which point do her body cells contain the highest amount of lactic acid? Explain your answer.



- "Anaerobic respiration could occur after the aerobic respiration". How far this statement is correct? With explanation.
- Write the number that indicates: the number of lactic acid molecules that resulted from one molecule of glucose in the anaerobic respiration.
- In the following figure, the process (1) occurs inside the small intestine, while the two processes (2) and (3) occur inside the living cell, where the compound (Z) increases, when feeling the muscular fatigue, in the light of this answer:

- (a) What are the compounds from (W): (Z)? And what are the processes from no. (1): (3)?
- (b) What is the reason for decreasing the carbon atoms to the half, on the occurrence of two steps no. (1) and (2)?
- (c) What are the conditions required for the occurrence of steps from no. (1): (3)?
- (d) What is the number of ATP molecules that resulted from one molecule of (W) through these processes?
- (e) What is the number of ATP molecules that resulted from the oxidation of one molecule of (Z) in case of returning to the rest state? Explain your answer.

Water bath

Graduated

cylindar

- 29 Explain: the aerobic respiration could occur without forming the pyruvic acid.
- Choose the anomalous word, then mention what links the rest:

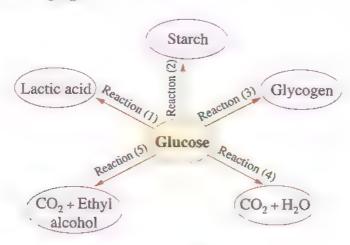
 Ethyl alcohol / Carbon dioxide / Muscular cells / Yeast.
- 31 What happens in case of: the exposure of some types of bacteria to a case of shortage or absence of oxygen?

Milk

- 32 In the opposite figure, a water bath is used whose temperature is suitable for the activity of both types of living organisms:
 - (a) In which graduated cylinder does
 the volume of mixture increase, after

 passing one hour from the beginning of experiment? Explain your answer.
 - (b) Illustrate the importance of using each of them in our daily life.

33 From the following figure:

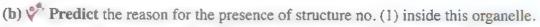


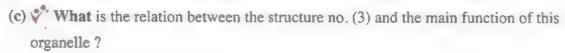
Which of the reactions from no. (1): (5) represents:

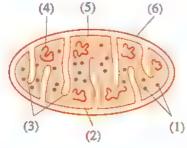
- (a) Aerobic respiration.
- (b) A change occurs inside the liver.
- (c) Anaerobic respiration in muscles.
- (d) Anaerobic respiration in yeast.
- (e) A reaction that forms an organic substance inside the plant (in storage sites).
- Explain: a diluted sugary solution is used during the alcoholic fermentation experiment.



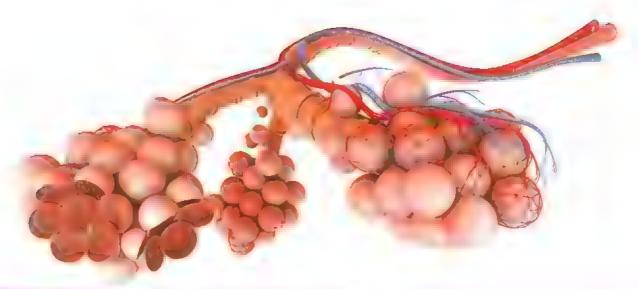
- 35 The opposite figure shows one of the living organelles inside the cell:
 - (a) Mention the number and name of the structure that:
 - 1. Contains the electron carriers.
 - 2. Presents inside the cell nucleus.







What is the similarity between: fermentation process and cellular respiration process? And what are the main conditions for the occurrence of fermentation process in the cells?

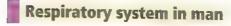




Respiration in Living Organisms

Respiration in man

 Human body contains a system that extracts the oxygen from the atmospheric air, then transfers it to the blood which delivers it to the body cells. This system is called "respiratory system".

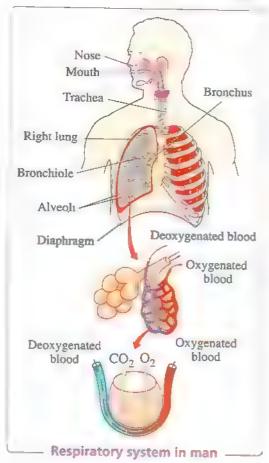


• It consists of many organs, where each one of them is suited to perform its function, as follows:

Nose or mouth

- The air enters the body through the nose or mouth, but it is preferable (from the hygienic point of view) for air to enter through the nose, because:
 - It is a warm passage, as it is lined with numerous blood capillaries.
 - It is moist, as it secretes mucus.
 - It serves as a filter, because it contains mucus and hairs which act as filters (sieves).







2 Pharynx

• Air passes through it and it is considered a common passageway for both air and food.

3 Larynx

• The air enters the trachea through it and it is known as the voice box.

4 Trachea

- Its walls contain a series of $\binom{3}{4}$ cartilaginous rings to keep it permenantly opened.
- Its inner surface is lined with cilia which beat upwards to filter the air passed through it by moving the small foreign bodies to the pharynx, so that they may be swallowed.
- It is divided at its lower end into two bronchi which divide and subdivide into progressively smaller and smaller branches called the "bronchioles", where each bronchiole finally ends with sacs called the "alveoli".

5 Lungs

- Each lung consists of a group of alveoli, bronchioles connected to them and the surrounding blood capillaries.
- Functional suitability of alveoli:
 - They are large in number that may reach about 600 million alveoli per lung to increase the respiratory surface area.
 - Their walls are considered the actual respiratory surface, because:
 - They are thin which increases the speed of gas exchanging process.
 - They are surrounded externally by a large network of blood capillaries whose blood receives oxygen from the alveolar air and from the bronchioles that are connected to them.
 - They are moistened by water vapour which is necessary for dissolving CO₂ and O₂ for completing the exchange of gases process between the alveolar air and the surrounding blood in the blood capillaries.

Role of the respiratory system in excretion process

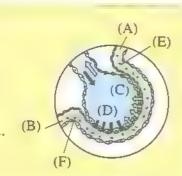
- The respiratory system in man excretes carbon dioxide, as well as it has an important role in the excretion of some water with the exhaled air in the form of water vapour, where:
 - Man usually loses daily about 500 cm³ of water through the two lungs out of 2500 cm³ of water that he loses daily.
 - This loss occurs as a result of the evaporation of water that moistens the alveolar walls and is necessary for dissolving oxygen and carbon dioxide to complete the gaseous exchange between the alveolar air and the surrounding blood in the blood capillaries (as mentioned before).

Test yourself

The opposite figure illustrates the path of blood around an alveolus:

(a) Determine the path of the blood by arrows in (A) and (B) on the figure.

- (b) What happens at: both of (C) and (D)?
- (c) Compare between: the two blood cells (E) and (F).



econd

Respiration in plant

Respiration process in plant:

Is a process in which the plant obtains the chemical energy that is stored in the form of organic molecules rich in energy (glucose) through a chain of reactions which include the breaking down of the carbon bonds in the organic substance to carry out one of its vital activities.

- Types of respiration in plant:
 - Aerobic respiration: in which the release of energy occurs by the oxidation process in the presence of oxygen.
 - Anaerobic respiration: in which the release of energy occurs in the absence of oxygen.

Respiration in most plants

• In most plants, each living cell is in a direct contact with the external environment, therefore the gaseous exchange process is easy to occur, where oxygen gas diffuses to inside the cell, while carbon dioxide gas diffuses to outside the cell.

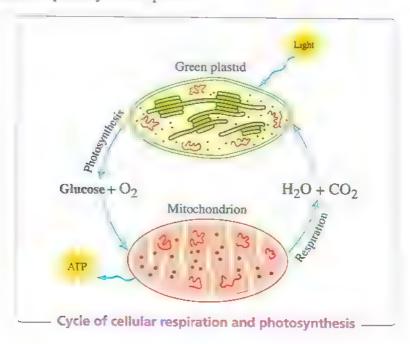
Respiration in vascular plants

- Oxygen gas reaches the cells through various passageways, such as :
 - The stomata of leaf: when they open, air enters to the air chambers and diffuses through the intercellular spaces that spread in various parts of the plant. So, the gas diffuses through the cell membranes and dissolves in the water of cell.

- The phloem passageways: some of oxygen dissolved in water is carried to the phloem passageway, so that it reaches the tissues of the stem and root.
- 1 The roots: oxygen enters the plant through them dissolved in water of the soil that is absorbed by the root hairs or imbibed by the root cell walls.
- The stomata of green plant stem and the lenticels or any cracks in the bark of woody stems: they act as an entrance for air.
- Methods of carbon dioxide gas expelling to outside (that is produced from the respiration):
 - By direct diffusion of the gas from the plant cells to the external environment, and this occurs in the cells which are on the surface, where they are exposed directly to the air or the soil.
 - For deep seated cells, carbon dioxide gas passes to the xylem or phloem tissues, then to the stomata and to the external environment.

Relation between photosynthesis and respiration processes in the plant

- What happens in the chloroplast is reversed in the mitochondria, where:
 - The plastids of green plants perform the photosynthesis process, producing glucose and oxygen gas.
 - Glucose and oxygen gas move to the mitochondria to release the energy through the respiration process.
 - Carbon dioxide gas and water that result from the respiration process move to the plastid to accomplish the photosynthesis process.

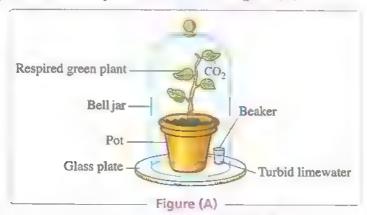




Experiment

1. Procedure:

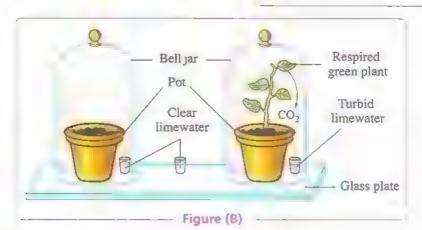
(1) Bring a green potted plant and place it on a glass plate and put a small beaker containing clear limewater next to it, then invert a glass bell jar over them, then cover the bell jar with a black piece of cloth, as in figure (A).



- (2) Prepare a similar apparatus with a pot that is empty of any cultivated plant.
- (3) Put some clear limewater in another small beaker and leave it between the two apparatuses, exposing to the atmospheric air.
- (4) Leave the two apparatuses and the beaker in between them for some time, as in figure (B).

Note

The bell jar is covered by a black piece of cloth, in order to keep the light away from the green plant and stop the process of photosynthesis which consumes CO₂ that presents in the air of bell jar or that released from the respiration.



2. Observation:

Limewater becomes turbid in step no. (1) only, and it doesn't become turbid in steps no. (2) and no. (3).



3. Explanations:

- In step no. (1), the green plant respires and produces carbon dioxide gas which caused the turbidity of limewater in the beaker.
- In steps no. (2) and no. (3), the limewater in the other two beakers shown no turbidity, due to the small percentage of carbon dioxide gas, either in the air of bell jar or in the atmospheric air.

4. Conclusion:

The green plant performs respiration process and releases carbon dioxide gas, as a result of this process.

The opposite graph illustrates the concentration of carbon dioxide that resulted from an agricultural crop within 24 hours. Explain: (a) The drop of the curve from (A) to (B).	Concentration of CO ₂ 0.040 (A) 0.038 (C) 0.036 (C) 0.032 (B) 0.030 (B) Time (hours)
(b) The elevation of the curve from (B) to (C).	

d Psychological state.

Respiration in Living Organisms



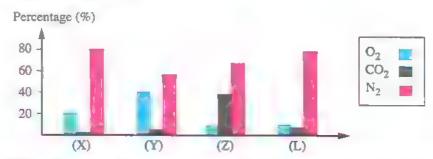
The questions signed by 🔗 measure the high levels of thinking.

Interactive Test

		Multiple	Choice Questio	ins			
1	In the opposite fi	gure :					
	(1) The air that e	nters to the two lungs is n	noistened in				
	the			(2) (1)			
	a part no. (4	only.		(3)			
	b part no. (2	e) only.		(5)			
	© part no. (3) only.		60			
	d two parts	no. (2) and (3).					
	(2) The mucus p	resents in the	(7) Tolland			
	a part no. (1) only.					
	(b) part no. (2) only.	((8)			
	© part no. (7) only.		(9)			
	d parts no. (_					
	_	represents the voice box i	s no				
	(a) (3).	(b) (4).	(c) (5).	(d) (7).			
	(4) Which of the	(4) Which of the following structures doesn't consist of cartilages?					
	(a) (5).	(b) (6).	(c) (7).	(d) (8).			
	(5) Which of the	following structures is/are		capillaries ? The			
	a part no. (2		(b) part no. (9)	_			
	c two parts	no. (2) and (9).	d two parts n	o. (2) and (8).			
2	The cilia that pre	sent in the trachea work o	n pushing the mucu	s with the minute foreign			
	particles towards						
	a nose.	b epiglottis.	© pharynx.	d two lungs.			
3	The respiratory tracts perform all the following, except						
	a filtering the a	ir.	b moistening	the air.			
	© gases exchan	ge.	d warming th	е аіт.			
4	Which of the	following doesn't/don't a	ffect the rate and de	epth of respiration?			
	a Physical exer	cises.					
	Ratio of each of oxygen and carbon dioxide in the atmospheric air.						
	© Respiratory enzymes.						

__3

5 From the following graph:



- (1) Which of the following samples represents the air entering to the two lungs?
 - a (X).
- (b) (Y).
- (Z).
- (d) (L).
- (2) Which of the following samples represents the air coming out from the two lungs ?
 - (X).
- (b) (Y).
- (c) (Z).
- (L).
- - a All the living cells respire.
 - (b) An amount of sugar is released from it.
 - © Plants respire day and night.
 - d Plants respire oxygen and release CO2 gas.
- All the following increases the rate of respiration automatically, except the
 - (a) increase of pH value in the blood.
 - b increase of carbon dioxide percentage in blood.
 - c increase of blood acidity.

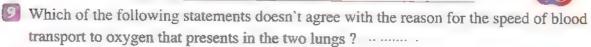
 decrease of haemoglobin percentage in red blood corpuscles.
- From the opposite figure, which of the following structures contains the highest concentration of CO₂ gas?



(2).

© (3).

- **d** (4).
- (1) —

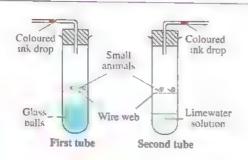


- Air that enters into the two lungs contains a greater amount of oxygen than the air that comes out of them.
- The alveoli are surrounded by a huge network of blood capillaries.
- The wall of alveolus is thin and its surface area is large.

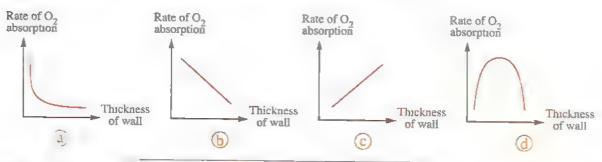
 The oxygen concentration in blood is less than its concentration in the alveoli.

10 The two opposite figures illustrate an experiment to measure the rate of respiration in some small animals. determine the direction of coloured ink drop in the two tubes

	The direction in		
	First tube	Second tube	
a	To inward	To outward	
6	To inward	Remains constant	
© To outward To		To inward	
(1)	Remains constant	To inward	



Which of the following graphs illustrates the relation between the rate of oxygen absorption and the change in thickness of alveolus wall?



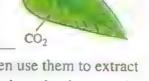
- 12 The main sites for gasous exchange in plant are the
 - a leaves.
- (b) lenticels.
- c) stomata.
- d roots.

- 13 The vital process that is illustrated by the opposite figure in plant is
 - a respiration.

(b) transpiration.

c photosynthesis.

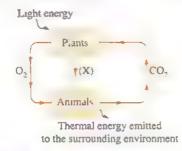
d transportation.



- 14 The plant cell can form the high-energy organic compounds, then use them to extract the energy required for performing its vital functions, this indicates that what happens in the
 - a) mitochondria is reversed in the chloroplast.
 - (b) chloroplast is reversed in the mitochondria.
 - c chloroplast is continued in the mitochondria.
 - d mitochondria is continued in the chloroplast.

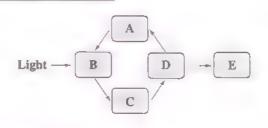
Сидетте 3

- In the opposite figure, (X) represents molecules.
 - (a) ATP
- (b) ADP
- © C₆H₁₂O₆
- d H₂O

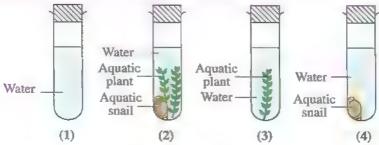


Miscellaneous Questions

- 1 What happens if: the nose is devoid of hairs and mucus?
- "If you know that bronchi contain cilia". Deduce the function of these cilia.
- 3 What happens if: the trachea is devoid of cartilaginous rings that present in its wall?
- Give reason: the presence of millions of alveoli in one lung.
- 5 What happens in case of: increasing the thickness of walls of alveoli?
- 6 Where is carbon dioxide formed in mammals? Illustrate by arrows how the body gets rid of it.
- Follow by arrows only: the route passed by CO₂ molecule that presents in a cell of small intestine, till its coming out from the body.
- 8 Study the opposite figure that illustrates one of the biological cycles which occur in the plant cell, if you know that letter (A) represents (CO₂ + H₂O). Deduce what the letters (B), (C), (D) and (E) represent in the figure.

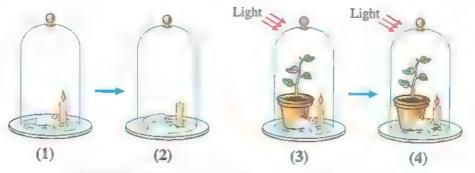


The following figures illustrate four test tubes were put in sunlight for several hours:

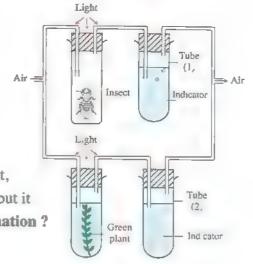


Explain what happens in each of the previous tubes.

- What happens in case of: putting a growing plant in a glass box that is covered by a black cover and devoid of oxygen then leaving it for several days?
- From the following figures, explain why the mouse died and the candle burnt out in the figure no. (2), and why the mouse lived and the candle remained light in the figure no. (4).



- Follow by arrows the steps of the arrival of an oxygen molecule to each of the following:
 - (a) Cells of skin epidermis.
 - (b) Cells of plant stem epidermis.
- What happens in case of: the uncovering of the bell jar in the experiment that proves the respiration of green plant parts with a piece of black cloth?
- Study well the opposite figure that represents an experiment to compare between the amount of carbon dioxide resulted from the respiration of an insect and an aquatic green plant, then answer:
 - (a) What is the name of substance that used in detecting CO₂?
 - (b) After one hour from the beginning of experiment, the indicator doesn't change in the tube no. (2), but it changes in the tube no (1). What is your explanation?
 - (c) What do you expect to happen, on putting the apparatus in darkness for a long time?



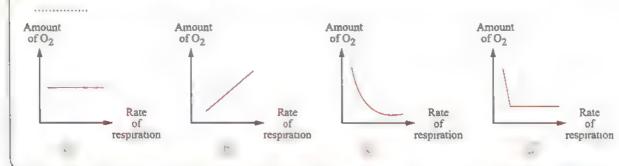
"Fish need in their farms a sufficient amount of dissolved oxygen to cover their respiration needs". Suggest several natural methods to decrease the need to pump oxygen in the fish farms.

Model Exam on Chapter 3

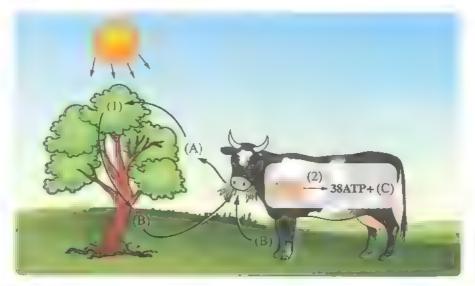


Choose the correct answer (1:21):

Which of the following graphs expresses the relation between the efficiency of the aerobic respiration rate and the amount of oxygen that is available in a muscular cell?



The following figure represents two vital processes (1) and (2) that occur inside the living cells of two different organisms:



Which of the following can be concluded from the two processes (1) and (2)?

- (a) The process no. (2) depends on the process no. (1).
- b The process no. (1) depends on the process no. (2).
- No one of them depends on the other.
- d Each one of them depends on the other.

- Which of the following are used by the cell as a rapid source to obtain energy? (a) Glucose molecules. Phosphoglyceraldehyde molecules. © Pyruvic acid molecules. d ATP molecules. The ratio of the number of FADH₂ to NADH that resulted from the complete oxidation of one molecule of glucose in aerobic conditions is (a) 1:5 (b) 3:1 C 5:1 (d) 1:3 The opposite figure illustrates the respiratory system in human, which of the following represents the functional units of this system ? ------(a) (1). **(b) (2)**.
- The following table represents 3 different stages for the oxidation of glucose molecule inside the living cell:

 Stage (1) Needs the presence of ATP molecules and occurs in the absence of

Stage (1)	Needs the presence of ATP molecules and occurs in the absence of oxygen.	
Stage (2)	Needs the presence of oxygen and occurs in the absence of ATP molecules.	
Stage (3)	Doesn't need to the presence of ATP molecules or oxygen.	

Which of the following represents the three stages (1), (2) and (3) respectively?

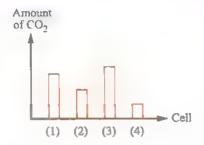
(a) Glycolysis - Krebs cycle - Electron transport chain.

© (3). (d) (4).

- **b** Krebs cycle Glycolysis Electron transport chain.
- © Electron transport chain Krebs cycle Glycolysis.
- d Glycolysis Electron transport chain Krebs cycle.



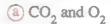
- The opposite graph represents the amount of CO₂ gas that resulted from four cells (1), (2), (3) and (4) at the same period of time, which of the following represents the most active cell?
 - (a) Cell no. (1).
- **(b)** Cell no. (2).
- © Cell no. (3).
- (d) Cell no. (4).



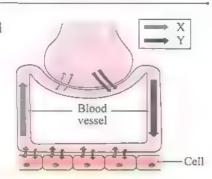
- All the following share in the arrival of oxygen gas to the cells of the herbaceous plants stems, except
 - a phloem passageways.
- **b** stomata.

c lenticels.

- d roots.
- Photosynthetic phosphorylation and oxidative phosphorylation,
 - are reversible processes.
 - b the first occurs in the mitochondria and the second occurs in the chloroplasts.
 - c the first needs energy and the second releases energy.
 - d are different in the source of energy.
- In the opposite figure, the two gases that are represented by the symbols (X) and (Y) are respectively.

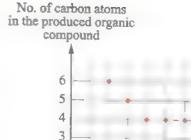


- (b) O₂ and CO₂
- CO2 and N2
- d N, and O,

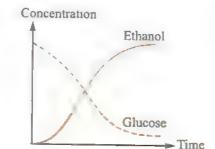


Time

The opposite graph represents the produced organic compounds during a stage of aerobic respiration, what is the number of ATP molecules produced during this stage?...........



- a One molecule.
- b Two molecules.
- © Three molecules.
- d Twelve molecules.
- The opposite figure shows the concentration of each of glucose and ethanol in an experiment was carried out in a cell, the reason for the shortage in glucose and increased ethanol is



- a citric acid cycle.
- b pyruvic acid reduction.
- c lactic acid fermintation.
- d glycolysis.
- What is the compound used in the aerobic and anaerobic respiration?



(b) FAD

© NAD+

(d) NADP

Study the following diagram which represents two vital processes occur in the living organisms, then determine: At which type of cell do these processes take place?

Glucose



- (b) Companion cell.
- © Spongy layer.
- Xylem parenchyma.



In the human lungs, the CO₂ and O₂ gases move through plasma membranes of the cells, which of the following choices is correct?

	The number of plasma membranes		
	O ₂ from the atmosphere	$CO_{\underline{2}}$ to the atmosphere	
la.	3	2	
h	3	4	
-	4	2	
	5	5	

(16)	Human and plant "according to respiration process" are
	a similar, because both of them have similar cellular enzymes.

- similar, because both of them respire without need to atmospheric air.
- different, because respiration is aerobic in human and anaerobic in plant.
- as a product.

Both of mitochondria cristea a	nd chloroplast membranes contain system for
a enzymes synthesis.	(b) PGAL production.
© electron transport.	d glucose formation.

The number of reduced coenzymes during oxidation of acetyl molecule aerobically is

(a) 3 (b) 4 (c) 5 (d) 10

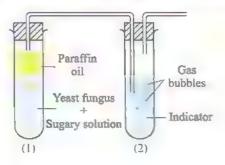
FAD and NAD molecules in anaerobic respiration exposed to
a oxidation. b reduction. c hydration. d decomposition.

© Consumes CO₂ d Loses electrons.

(21) Study the two figures then conclude: What represented by the arrow no. (1) and arrow no. (2) respectively? a Carbon dioxide and Oxygen. b Water vapor and Carbon dioxide © Oxygen and water vapor. d Oxygen and Carbon dioxide. Answer the following questions (22:27): Give reason: nitrogen gas doesn't transfer to the blood. What happens if: the human respires polluted air with dust? 24 What is the similarity between: the anaerobic respiration in bacteria and anaerobic respiration in yeast fungus? "The human respiratory system has no role in the excretion of water from the body". How far this statement is correct? With explanation.



The following figure illustrates an experiment, examine it then answer:



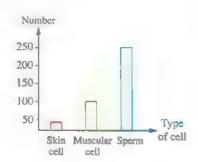
Concentration of CO ₂ in the solution	Colour of indicator
Very low	Blue
Low	Green
High	Yellow

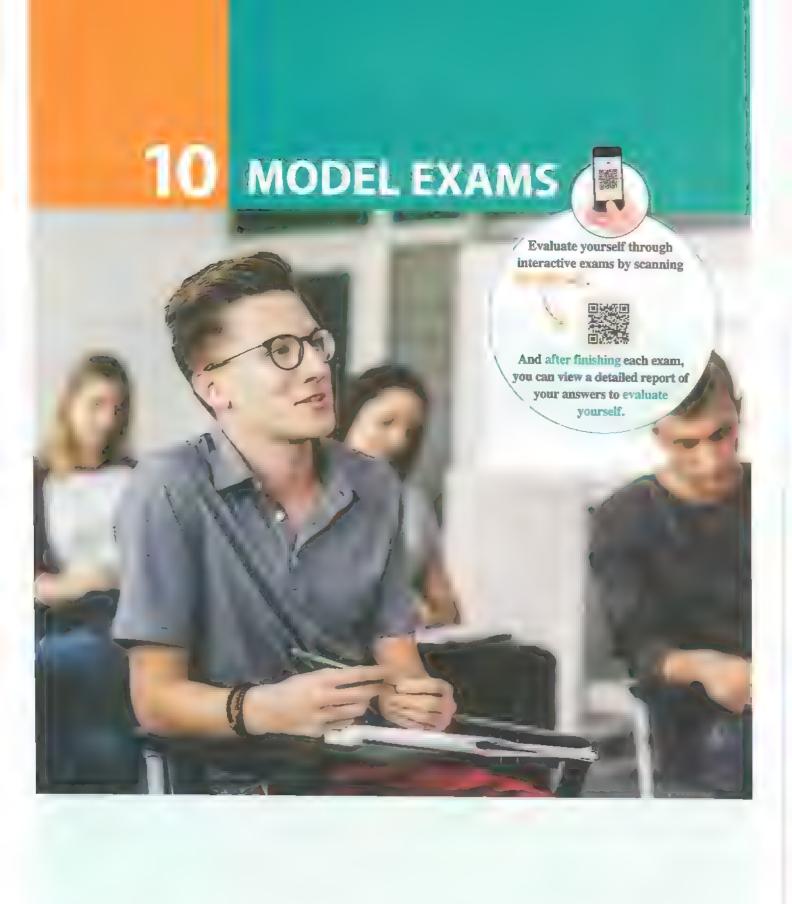
- (a) What is the purpose from placing a layer of paraffin oil in the tube no. (1)?
- (b) What is the colour of the solution in tube no. (2) that is expected at the end of experiment?

The opposite graph illustrates the number of mitochondria in 3 different types of cells:

Determine which type of cells needs more glucose molecules to perform its function.

Explain your answer.







Model Exam

Choose the correct answer (1:21):

- In which of the following parts of the human digestive system, does the process that illustrated in the opposite diagram occur?..........
 - J Stomach and duodenum.
 - Oesophagus and duodenum.
- (b) Mouth and stomach.
- Mouth, stomach and duodenum.
- Which of the following living organisms can use the phosphoglyceraldehyde in the cellular respiration?......
 - Green algae.

(b) Human.

Protein

© Yeast fungus.

- d Green algae and human.
- Which of the following can be used as a drug to prevent the formation of blood clots in some patients?.....
 - a Fibrin.
- **b** Fibrinogen.
- © Heparin.
- (d) Thrombin.

- The opposite graph illustrates the concentration of elements (X), (Y) & (Z) in the cells of a plant and in the soil solution, which of the following element(s) do the rates of respiration during their (its) absorption increase?
 - h ease ?

(X).

(b) (Y).

(c) (Z).

- (d) (X) and (Z).
- Concentration

 Orange columns: Plant cells

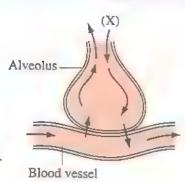
 Blue columns. Soil solution

 Elements
- The leaf of cotton plant contains all the following tissues, except
 - a) mesophyll tissue.
- **b** xylem.
- © phloem.
- d cambium.

In the opposite figure, which of the following factors works on increasing the penetration rate of gas (X) from the alveolus to the blood vessel?



- b Increasing the surface area of the alveoli.
- Decreasing the concentration of the gas (X) in the alveoli.
- d Decreasing the respiration rate.



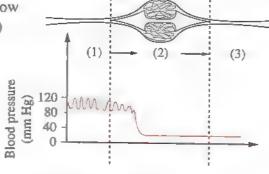
Which of the following valves direct the blood route which contains the highest percentage of carbo-aminohaemoglobin substance?

a Mitral valve and tricuspid valve.

- (b) Mitral valve and aortic valve.
- © Pulmonary valve and aortic valve.
- d Tricuspid valve and pulmonary valve.
- The opposite figure illustrates the blood flow in the blood vessels, what does the part no. (1) represent?.....



- b Vein.
- © Blood capillaries.
- d Lymphatic vessel.



- Which of the following statements agrees with Krebs cycle?.......
 - It is always related to glycolysis process forming pyruvic acid.
 - **b** It occurs inside the mitochondria.
 - The biggest direct source to produce ATP molecules in the cell.
 - d Citric acid is an intermediate compound in it.



The gas exchange process between the air present inside the alveolus and the blood in the two lungs is occurred by phenomenon.

- (a) osmosis
- (b) diffusion
- c active transport
- (d) imbibition

Which of the following graphs represents the relation between the number of root hairs and the amount of absorbed water? Number of root hairs Number of root hairs Number of root hairs Number of root hairs Amount of Amount of Amount of Amount of absorbed water absorbed water absorbed water absorbed water (a) **(b)** (c)

- Which of the following blood components, can the body make benifit from them through their different stages?........
 - (a) Platelets.

WBCs

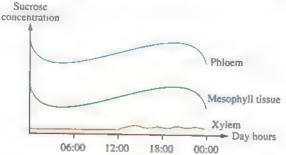
© Plasma proteins.

- d RBCs
- When pyruvic acid converted into lactic acid, NADH subjected to process. (a) reduction **b** oxidation

c splitting

- **decomposition**
- Which of the following digestive organs may have dysfunction in a person. So, the doctors advised him not to eat more food rich in fats?.....
 - a Pancreas.
 - 6 Small intestine.
 - © Oesophagus.
 - d Stomach.

The following graph shows the results of measuring sucrose sugar concentration in three different tissues in the leaf of a dicot plant during 24 hours:



Which of the following can be concluded from that graph?......

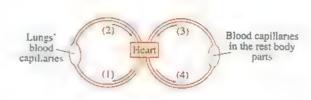
- a Water moves by osmosis from Xylem to phloem.
- Sucrose moves by active transport from the mesophyll to the leaves then to the phloem.
- © Sucrose moves in both directions in the phloem.
- Xylem tissue uses sucrose sugar as a source of energy.
- Chloroplasts and mitochondria are similar in the
 - a presence of DNA molecules.
 - b presence of NAD molecules.
 - © production of sugar molecules.
 - d glycolysis (splitting of glucose molecules).
- Babies' milk contains lactose sugar, how can the baby make benefit from this sugar? ...
 - a Lactose metabolism leads to fast energy production.
 - Lactose transfers through cell membranes to be absorbed fastly.
 - C Lactose contains more stored energy than milk protein.
 - The breaking down of chemical bonds between lactose molecules produces high rate of monosaccharides.
- In the opposite figure, which of the following blood vessels carry blood at high pressures?



(b) (1), (4).

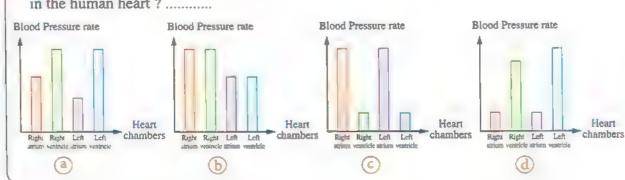
© (2), (3).

(d) (2) , **(4)**.





- The narrow diameter of xylem tubes in plant stem causes
 - a inability of water transfer through xylem tubes.
 - b water and salts transfer by capillarity phenomenon.
 - water and salts transfer by capillarity phenomenon and adhesion.
 - d lignin precipitation inside xylem tubes' cavity.
- Which of the following graphs expresses the strength of chambers muscles contraction in the human heart?.....



- (M) Which of the following use sunlight in a direct way?............
 - a Production of ATP molecules.
 - 6 Movement of chlorophyll molecule electrons.
 - © Water molecules splitting.
 - (d) NADPH, molecules formation.

Answer the following questions (22:27):

- Explain: the presence of root hairs in the bean plant, despite of their continuous penetration in the soil.
- What is the least number of each molecule of NADH and FADH₂ at which the number of ATP molecules resulted from them is equal?



Write the scientific term: "An organ in the body through which oxygenated and deoxygenated blood enter inside it and the deoxygented blood comes out from it".

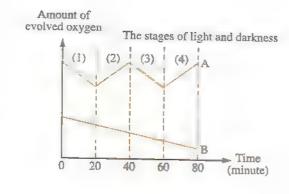


"Superior vena cava carries completely digested substances".

How far the statement is correct? With explanation.

26 The radioactive carbon has an important role in proving some vital processes inside the plant. Give two different examples.

An aquatic plant was put in a medium containing water H28O and mineral salts, whereas water contains dissolved oxygen (16O2) and also a source of carbon dioxide (C16O2), then the plant exposed to light and darkness in a successive manner.



from the opposite graph:

- (a) Which of the stages from (1): (4) represents the darkness?
- (b) Which curve represents the oxygen (16O)?



Model Exam 2

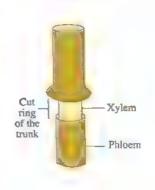
Air pump-

Choose the correct answer (1:21):

In the opposite figure, the air pump is used to supply the green algae with



- O₂ that is required for their respiration.
- © CO, that is required to perform photosynthesis process.
- (i) O₂ that is required to perform photosynthesis process.
- A woman suffers from general weakness, high rate of heartbeats and high respiration rate, on examining her blood picture, it is expected to find
 - a an increase in the number of red blood corpuscles.
 - an increase in the number of white blood corpuscles.
 - a decrease in the number of red blood corpuscles.
 - d a decrease in the number of white blood corpuscles.
- The amount of energy released from a molecule of fatty acid after completing Krebs cycle depends on all the following, except the
 - a number of acetyl groups resulted from its breaking down.
 - b number of carbon atoms which enter in its composition.
 - © accomplishment of electron transport chain.
 - d number of coenzymes (A).
- In the opposite figure, when removing a ring from the trunk of a plant, which of the following is expected to occur?.........
 - Water doesn't reach the root.
 - b Water doesn't reach the leaves.
 - © Dissolved salts don't reach the leaves.
 - Amino acids and carbohydrates don't transfer to the roots.



Light source

Glass container

Water containing

green algae

Air bubbles

Pores

- Which of the following reactions require the presence of CO_2 gas ? a Light reactions only.
 - b Dark reactions only.

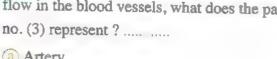
C Light and dark reactions.

- d Glycolysis reactions.
- When staining a transverse section of a dicot plant stem with iodine solution, which of the following is expected to appear with a dark blue colour?
 - a Xylem vessels.

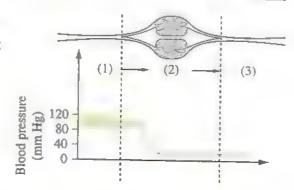
(b) Companion cells.

© Cambium.

- The innermost row of cortex.
- The opposite figure illustrates the blood flow in the blood vessels, what does the part



- (a) Artery.
- (b) Vein.
- © Blood capillaries.
 - Lymphatic vessel.



- The ratio between the number of FADH₂ molecules to that of NADH molecules resulting from the complete oxidation of a molecule of glucose in aerobic conditions is respectively.
 - (a) 1:5

- (b) 3:1
- © 5:1
- **d** 1:3
- Gallbladder was removed from a person, which of the following is expected to occur?......
 - (a) He can't eat carbohydrates.
 - b He can eat fats in small amounts.
 - (c) He can take drinks only.
 - d He can't eat more than one big meal daily.
- (10) From the opposite figure, the phenomenon by which substance (A) transfers, is

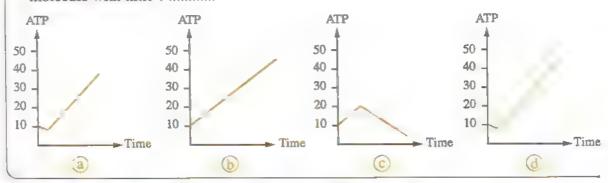


- b imbibition.
- c diffusion.
- d active transport.

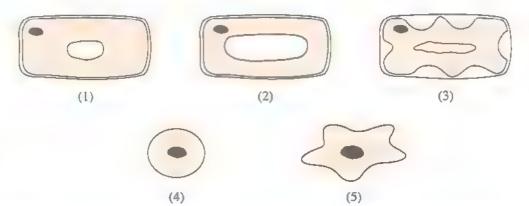




If we supposed that the cell storage for energy is 10 ATP, which of the following graphs represents the number of ATP molecules after the aerobic oxidation of glucose molecule with time?...........



The following figures show some plant and animal cells after placing them in two sucrose solutions having different concentrations (knowing that their osmotic pressure = 0.5 % the sucrose solution).



Determine which of the previous cells, were placed in these two solutions

	Sugar solution (0.1%)	Sugar solution (1%)
(a) cell (1) & cell (2) cell (3) & cell		cell (3) & cell (5)
6 cell (1) & cell (4) cell (cell (3)
cell (2) & cell (4) cell (1) & cell		cell (1) & cell (3)
3	cell (3) & cell (5)	cell (2) & cell (4)

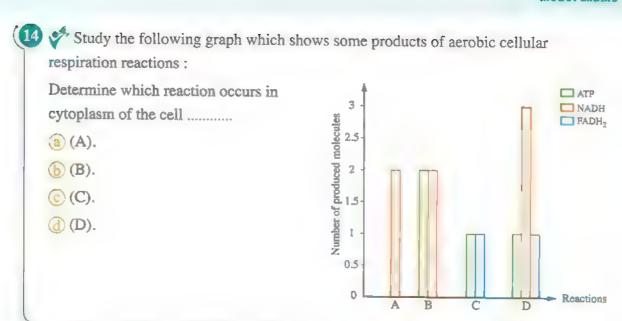
Each 100 cm³ of plasma contains an amount of protein which equals g in normal person.

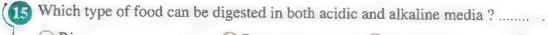
3

b 3

© 7

d 9





a Rice.

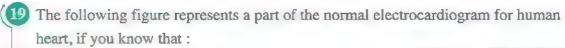
- (b) Potato.
- © Fat.
- Meat.
- The blood vessel which contains the highest amount of glucose in human body is
 - a inferior vena cava.

b hepatic portal vein.

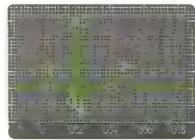
© pulmonary artery.

- d hepatic vein.
- The green plants are similar to purple-sulphur bacteria in the
 - (a) type of chlorophyll in both of them.
 - source of hydrogen required for CO₂ fixation in both of them.
 - c dark reactions in both of them.
 - secondary products of photosynthesis process in both of them.
- What are the types of food needed by a person who practices bodybuilding?
 - a Juices & vegetables.
 - (b) Rice & juices.
 - © Meat & juices.
 - d Rice & vegetables.

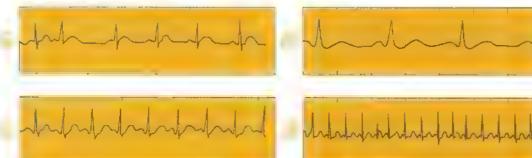




- Part (P) represents contraction of atria to pump the blood to ventricles.
- Part (QRS) represents the contraction of ventricles to pump the blood outside the heart.
- Part (T) represents the secondary contraction of ventricles to pump blood residues outside the heart.



Which of the following diagrams represents the slow heartbeats rate?





If you plant normal plants in desert and small number of them adapted well with this environment, which of the following factors its increase leads to the adaption of these plants ?

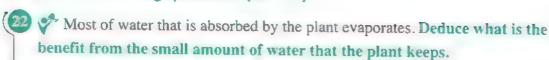
- (a) The tallness of vegetative parts of the plant.
- b The concentration of cell sap of root cells.
- The shortness of the root.
- d The small volume of sap vacuoles of the root.



21 The highest value of blood pressure is at the

- a relaxation of left ventricle.
- b contraction of right ventricle.
- c opening of mitral valve.
- d opening of semi-lunar valves.

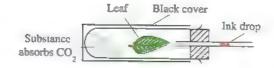
Answer the following questions (22:27):



- Explain: the proteins that are produced by the plant cells to perform the required vital processes can't penetrate through their plasma membranes.
- There is a reaction that links between the glycolysis and Krebs cycle during the cellular respiration, illustrate the products of this reaction.
- What is the difference between: the blood capillaries that present in villi and that present in the alveoli?

(a) Determine the direction of the ink of

(a) **Determine** the direction of the ink drop movement in the tube.



- (b) Explain why the substance that absorbs CO2 is added.
- "The stomach has an important role in protecting the human body".

 How far the statement is correct? With explanation.



Model Exam 3

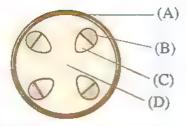
Choose the correct answer (1:21):

- 1 The opposite figure illustrates a diagrammatic section in the stem of a dicot plant, in which of the following tissues does suger transfer?..........
 - (A).

(b) (B).

© (C).

(d) (D).



- (2) The blood that is carried by the arterioles inside the lung
 - a contains digested food.
 - b contains a higher percentage of O, than CO,
 - contains a higher percentage of CO₂ than O₂
 - d contains an equal percentage of CO2 and O2
- The number of removed electrons from one molecule of glucose which contribute by their transfer from a higher energy level to a lower energy level in the electron transport chain is
 - (a) 12

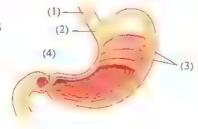
- **b** 24
- © 36
- **d** 38
- Some of the patients who have digestion complications suffer from the "Gastro-oesophageal reflux" which causes severe inflammation in the oesophagus, this is due to a distrubance in the part no.



(b) (2).

© (3).

(4).



- Which of the following valves determine the blood route which contains the highest percentage of oxyhaemoglobin substance?......
 - (a) Bicuspid valve and tricuspid valve.
 - b Bicuspid valve and aortic valve.
 - Pulmonary valve and aortic valve.
 - d Bicuspid valve and pulmonary valve.

- Which of the following gives the highest blood pressure in aorta?.... Right atrium contraction. b Left atrium contraction. Right ventricle contraction. d Left ventricle contraction. Which of the following substances doesn't transfer through the plant transport system?..... a H,O (b) Glucose. (d) Mg²⁺ © Cellulose. You have 4 test tubes as shown in the following figure, in which tube will the O2 concentration decrease rapidly ?.. Black box to prevent the light Sunlight Sunlight Water Snail Plant The corn plant differs from Orobanche plant in all of the following, except a performing photosynthesis process.
 - b the fixation of CO, gas.
 - converting low-energy compounds to high-energy compounds.
 - converting organic compounds into inorganic compounds.
- (10) In which of the following plants do you expect that the osmotic pressure is vanished?....
 - (a) Cotton.
- Bean.
- (C) Maize.
- d Pinus.



- What happens to ketoglutaric acid when it is converted into succinic acid during cellular respiration? It
 - a combines with O,
- b consumes ATP molecules.
 - c consumes CO,

d loses electrons.

Z

- Which of the following represent the reactants (substrates) for each of enzyme A, B respectively?.....
 - (a) (Y), (L).
 - (b) (Z), (L).
 - (Y),(X).
 - (X), (Z).

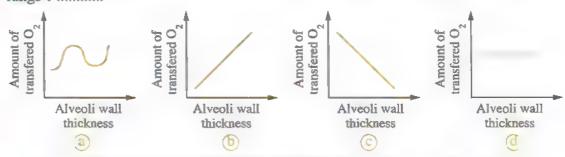


Substrate

X



- Which of the following doesn't agree with glycolysis reactions and the reactions which occur in chloroplast stroma?
- a Both of them need energy.
- **b** PGAL compound is formed in both of them.
- © Each of them occur in many steps.
- d Each of them produces CO,
- Which of the following graphs expresses the efficiency of air sacs (alveoli) in the two lungs ?



- Which of the following occurs when placing plant cell in a salt solution whose temperature is 90°C?
 - Water and salts absorption stops completely.
 - **b** Salts absorption stops and water absorption doesn't stop.
 - © Water and salts absorption stops partially.
 - Water absorption stops.

			Model Exa
The presence of a layer of cambium in the an increase in the transport rate. b wideness in the secondary xylem cavities a decrease in the stem support. an increase in the lenght of phloem tubes	3.	icot plant lead	ds to
In the opposite figures, in which tube does the complete digestion occur?	Amylase H ₂ O starch pH = 7.4	Lipase Bule PH = 8	Fats + H ₂ O + Bile PH = 8
The opposite figure shows the connection be two veins, which of the following shows the direction of venous blood? a C — A and A — B b B — C and A — C c A — C and A — B d C — A and B — A	etween	c	B Valve
Which of the following is responsible for aer a Palisade. b Spongy.		t leaves ?	tissue.
During oxidation of maltose molecule, the nu from Krebs cycle is	imber of resu	lted ATP mole	ecules directly

(21) Human body contains a group of fluids that differ in their structure, which of the following expresses the components of plasma?

© 4

	Water	Urea	Antibodies	WBCs
<u>a</u>	/	1	✓	×
Ь	✓	1	30	×
©	1	1	√	1
<u>d</u>	ж	30	✓	1

b 2

a 1

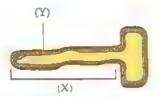
✓	: Present
×	: Absent

d 8



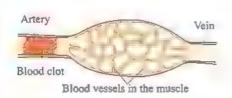
Answer the following questions (22:27):

- Explain: the lymph plays an indirect role in the blood clotting.
- What happens in case of the absence of the part (Y) from the structure (X)?

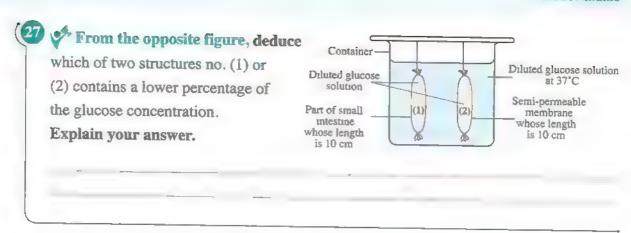


- What is the relation between: the conversions of ATP into ADP and the change in the compounds during glycolysis?
- The opposite figure illustrates the formation of a blood clot inside an artery of a certain muscle, mention the name of the harmful substance that accumulates in the tissues of the muscle.

 Explain your answer.



PGAL is formed during two important processes that you have studied, determine the role of this compound in each of the two processes.





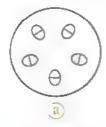
Model Exam

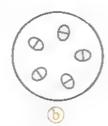
Choose the correct answer (1:21):

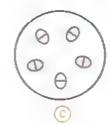
- After eating a meal rich in fats, the highest concentration of the fatty acids will be in the
 - a hepatic vein.
 - inferior vena cava.

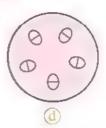
- hepatic portal vein.
- d superior vena cava.
- which of the following figures represents a transverse section in the stem of a dicot plant?











- When the number of the red blood corpuscles in an adult person reaches 3 million cells/mm³ of blood. So,
 - a the degree of red colour of the blood remains constant.
 - b the haemoglobin percentage increases in the blood.
 - the iron percentage increases in the blood.
 - d the iron and haemoglobin percentage decreases in the blood.
- Increasing the rates of elements diffusion against the concentration gradient is related to all the following, except
 - a increasing the active transport.
 - b the plant need for more phosphorus.
 - © the absorption of macro-nutrients only.
 - d increasing the respiration rates.



The relaxation of the walls of right atrium is synchronized with the

a opening of mitral valve.

6 opening of pulmonary valve.

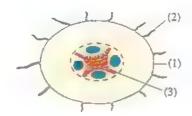
© opening of tricuspid valve.

d closure of aortic valve.



The opposite figure illustrates a transverse section in the plant root, which of the following parts absorb(s) water and salts ions mainly?.....

- (a) (1).
- **(**2).
- © (1) and (2).
- **(d)** (3).



air that enters in the two lungs contains lower amount of O_2 than the air comes out from them.

- b wall of alveolus is thick and has a large surface area.
- concentration of O₂ in the blood is higher than its concentration in the alveolus.
- Which of the following statements doesn't agree with the heart blood circulation?

 When the two ventricles contract, the valves between atria and ventricles close.
 - 6 When the two ventricles relax, the semi-lunar valves close.
 - When the two atria contract, the semi-lunar valves open.

 When the two atria contract, the valves between atria and ventricles open.



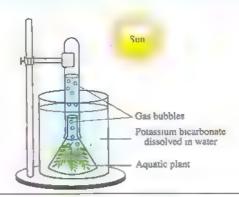
The fermentation in yeast fungus differs from the fermentation in exhausted muscle fiber in

the increase of released energy amount from one molecule of glucose.

- b releasing less amount of CO,
- c breaking down of lower number of chemical bonds.
- d that the fats and proteins aren't used as a source of energy.



- From the opposite figure, the evolved gas from this experiment is
 - a carbon dioxide.
 - b hydrogen.
 - © nitrogen.
 - d oxygen.

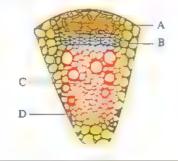


- Which of the following statements describes the enzymes which present in the uncooked fruits and vegetables?.........
 - a The plant enzymes don't work inside the plant body.
 - The enzymes change their reacting substances inside the human body.
 - The enzymes present in them become inactive by heating and cooking.
 - d The enzymes increase the activation energy.
- Study the opposite figure which shows a part of T.S. in a dicot plant stem, which of the following expresses the undifferentiated cells?...
 - (A).

b (B).

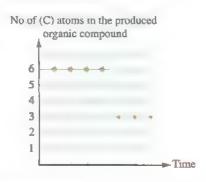
© (C).

(D).



- From which do the walls of blood vessels ends, that spread between the cells of liver tissue are formed?
 - Epithelial layer.

- **(b)** Epithelial and muscular layers.
- Muscular and connective layers.
- Muscular layer.
- - a Paramicum.
- bacteria.
- C Amoeba.
- d yeast fungus.



A child ate a meal contains wheat and milk, what is the suitable pH for the action of several enzymes together to digest this meal?. (a) 5 **8 (b)** 166 Which body organ can perform the formation and destroying of two types of blood components?..... . Heart. b Liver. Pancreas. d Spleen. Which of the following graphs describes the evolved O2 amount from a plant during the morning hours?.... Amount of O, Amount of O Amount of O. Amount of O Morning Morning Morning Morning hours hours hours hours (18 🎺 Study the opposite graph which shows some of the photosynthesis process products, then No. of molecules determine which of the following occurs during ATP ☐ ADP this stage a formation of H₂O molecules. (b) oxidation of NADPH, O₂ releasing. Compounds d CO2 reduction. 19 Study the following diagram: Blood capillaries -Alveolus

Which of the following represents (X) and (Y) respectively?

(a) CO2, O2

© Water vapour, O,

(b) O, , CO,

Water vapour, CO2

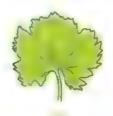


- Respiration occurs with high rate after performing a running race. So, the body works on
 - a oxidation of lactic acid.

(b) oxidation of NADH

c reduction of pyruvic acid.

- d ATP molecules decomposition.
- Which of the following plant leaves produces greater amount of oxygen at daytime?.....



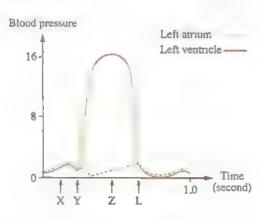




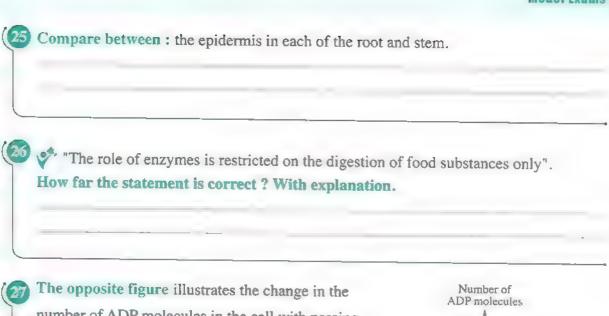


Answer the following questions (22:27):

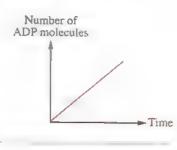
- What is the similarity between: glycolysis and Krebs cycle?
 - The opposite graph illustrates the changes in the blood pressure for each of the left atrium and left ventricle during the heartbeat, determine the time at which the mitral valve closes.



Explain: the entrance of the oxygen or air differs in the stem of herbaceous plant from the woody stem.



The opposite figure illustrates the change in the number of ADP molecules in the cell with passing time, is the mentioned cell in an active state or not? Explain.





Choose t	he correct	answer	(1:	21)	-
----------	------------	--------	-----	-----	---

process?			
a Iron.	b Phosphorus.	© Magnesium.	d Calcium.

- a) the nodes that work on getting rid of pathogens.
- b a network of arteries.
- a network of blood capillaries.
- (d) an immunization function.
- The tissue which has the ability to divide mitotically in the plant is the

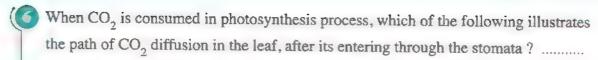
 a xylem.

 b phloem.

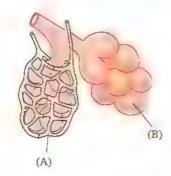
 c palisade tissue.

 d cambium.
- - the first process (1) is anabolism and the second process (2) is catabolism.
 - d the first process (1) is catabolism and the second process (2) is anabolism.
- Water is important in photosynthesis process, as it is considered

 a a solvent for carbon dioxide gas.
 b a source for the evolved oxygen.
 c a source for hydrogen that is required for the reduction process.
 d a receiver for the light energy.



- a) Cell wall -> Plasma membrane -> Intercellular spaces -> Cytoplasm -> Plastid's membrane.
- Intercellular spaces → Cell wall → Plasma membrane → Cytoplasm → Plastid's membrane.
- © Intercellular spaces → Plasma membrane → Cell wall → Plastid's membrane → Cytoplasm.
- Intercellular spaces → Cytoplasm → Plasma membrane → Cell wall → Plastid's membrane.
- In the opposite figure, the structure (B) is surrounded by a network of structures (A) to transfer easily.
 - (A) to (B)
 - (b) CO₂ from (B) to (A)
 - © H₂O from (B) to (A)
 - (d) O₂ from (B) to (A)



- - a the two statements are correct.
 - b the two statements are wrong.
 - the first statement is correct and the second statement is wrong.
 - d the first statement is wrong and the second statement is correct.
- If the blood pressure value is 110/70 mm Hg. So, the measurement of the number 110 is synchronized with the
 - a relaxation of ventricles.

- **b** contraction of atria.
- opening of the valves with flaps.
- opening of semi-lunar valves.



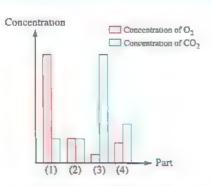
The opposite diagram represents the concentration of CO₂, O₂ gases in the blood in different body parts:

Which of the following represents the blood flow through aorta?

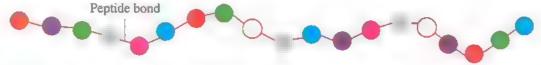


(b) (2).

d (4).



Study the following figure, then determine:



Which of the following ends the digestion of this compound completely?

a Duodenum amylase.

(b) Stomach pepsin.

© Small intestine trypsin.

d Small intestine peptidase.

- Which of the following can't be transferred through the phloem and xylem tissues?
 - (a) Amino acids.

(b) Sucrose.

© Starch.

d H₂O

- Pulmonary artery is similar to the limbs' veins in that
 - a both of them contain oxygenated blood.
 - both of them contain de-oxygenated blood.
 - c both of them have valve.
 - (d) (b) and (c) together.
- The following table shows the nutrients that found in a piece of candy, which one of them wouldn't be digested?.....

Sample	Nutrient	Amount (g)
a	Fat	3
Ъ	Glucose	3
©	Protein	2
(d)	Starch	6

- - (3) Osmosis. (4) Active transport.

 (a) (1), (2). (b) (1), (4).

 (c) (2), (4). (d) (1), (3) & (4).
- Which of the following accompany the formation of glucose 6-phosphate?....

 a Energy production.

 b Energy consumption.

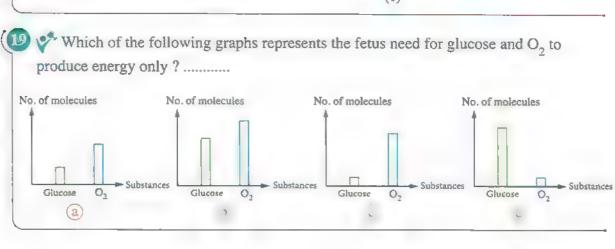
 c CO₂ production.

 d O₂ consumption.
- What is the result of absence of the pits from xylem vessels in a plant leaf?......
 Increasing in the salts and H₂O transfer to the palisade cells.

 Stopping the light and dark reactions.

 Stopping the transfer of sucrose and amino acids.

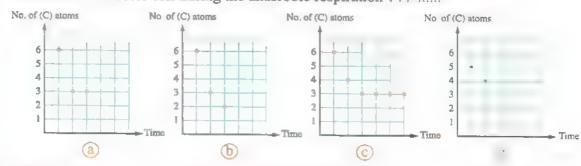
 Increasing the dark reactions rate.





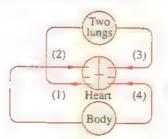
- If the soil is soaked with water, the absorption of salts by the plant decreases, due to
 - (a) decreasing of salts in the soil.
 - b less O₂ in the soil.
 - © more O₂ in the soil.
 increasing in the production of ATP in the root cells.

Which of the following graphs represents the reactions that happen to a glucose molecule in a muscle cell during the anaerobic respiration?.......



Answer the following questions (22:27):

- Explain: the root hairs are characterized by high osmotic pressures in the salty and desert soils.
- The opposite diagram represents the blood circulation in human, which contains an arrow with wrong direction. Determine its name.



Compare between: The anaerobic respiration in animal cells and plant cells.

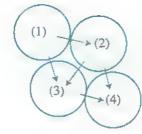
The opposite figure illustrates some vital	(1) (2)
processes that occur in the cells of living organisms,	The final Doesn't
examine it then answer:	product is (3C) compound Needs need O2 the
(a) How many ATP molecules are produced	Takes enzymes
from the complete oxidation of one molecule	in the animal cell Produces CO ₂
of glucose in process no. (3)?	Needs oxygen
(b) Arrange the processes from (1): (3) descendingly, a	ccording to their energy
production.	ccording to their energy
production.	ccording to their energy
From the opposite figure, determine by arrows	ccording to their energy
From the opposite figure, determine by arrows a simple pathway for the absorbed food substances	ccording to their energy
From the opposite figure, determine by arrows a simple pathway for the absorbed food substances through the two vessels no. (1) and (2), till	ccording to their energy
From the opposite figure, determine by arrows a simple pathway for the absorbed food substances	ccording to their energy



Choose the correct answer (1:21):



The opposite figure represents the movement of water transfer by osmosis phenomenon between four adjacent plant cells, which of the following cells has the highest concentration of salts?



(a) (1).

(2).

(c) (3).

(d) (4).



Which of the following doesn't agree with the chlorophyll function in the green plants? The

- a conversion of the light energy into chemical energy that stored in the food molecules.
- b absorption of the light energy that is required to perform the photosynthesis process.
- c storage of the kinetic energy of light as a chemical potential energy.
- d storage of the raw materials that are required to perform the photosynthesis process.



Which of the following doesn't agree with the occurrence of anaerobic respiration in the muscle? The

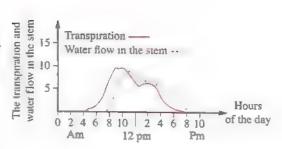
- (a) increase of lactic acid in the blood.
- b depletion of oxygen in the blood that reaches the muscle.
- c consumption of a large amount of glucose.
- d muscle fatigue.



The least blood pressure value in the human is at the

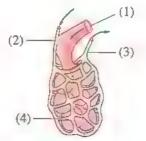
- (a) contraction of left ventricle.
- b relaxation of right atrium.
- closure of bicuspid valve.
- d closure of semi-lunar valves.

- From the opposite graph, it can be concluded that
 - (a) the transpiration rate is constant all the day.
 - b there is no relation between the water flow in the stem and the transpiration rate.
 - © the highest flow of water in the stem is delayed for the highest transpiration rate.
 - d the transpiration rate can't reach zero.



- From the opposite figure, which of the following structures contains the highest concentration of O₂ gas?......
 - (1).
 - © (3).

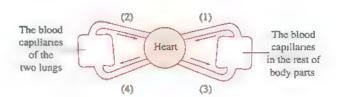
- **(**2).
- **(**4).



- Which of the following statements is applied on the digestive juices that are secreted by the liver and pancreas?.....
 - (a) They digest the same food substances.
 - b They work at the same pH value.
 - © Their enzymes need activators to work.
 - d The same products of digestion are produced by their action.
- How the reaction of $(C_6H_{12}O_6 + 6O_2 6CO_2 + 6H_2O + 38 \text{ ATP})$ affected, when the number of coenzymes decreases in mitochondria?
 - (a) The glucose will be formed again.
 - b The water will not be from the reaction products.
 - © The number of resulted ATP molecules will decrease.
 - d The number of CO, molecules will decrease.



- In the opposite figure, which of the blood vessels carry oxygenated blood?......
 - (1) & (2).
 - **(b)** (1) & (3).
 - (c) (2) & (3).
 - (1) (2) & (4).



- During the passage of the food bolus in the oesophagus,
 - a the proteins digestion starts.
 - b the fats digestion starts.
 - c the carbohydrates digestion continues.
 - d the digestion process is stopped.
- (11) The anaerobic cellular respiration requires the presence of
 - $\bigcirc O_2$
 - **ⓑ** CO₂
 - c specific enzymes.
 - (d) FAD
- The root pressure stops when
 - a) the water exits out from the stem by excudation.
 - b the water transfers to root cells by imbibition.
 - it increases more than 2 atmospheric pressure (atm).
 - it becomes equal to the pressure of water column in xylem vessels.
- Which of the following may occur if suberin precipitated on the doubled-membrane of chloroplasts?.....
 - a Difficutly in the light passage.
 - (b) Chlorophyll won't be formed.
 - © High speed of O₂ formation.
 - Water passes easily.

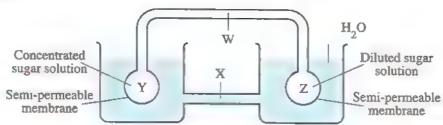
The following graphs describes the relation between rate of anabolism and catabolism in 3 persons differ in the age-stage:



Which the following represents the arrangement of the 3 persons from the first to the third?

- (a Childhood-Youth-Elderhood.
- 7 Youth-Childhood-Elderhood.
- © Elderhood-Childhood-Youth.
- Youth-Elderhood-Childhood.
- The living cells keep the internal concentration of ions which differs from the external concentration and this concentration difference continues by the help of
 - a cells' walls.
- b stomata.
- cells' membranes.
- d plastids.
- Which of the following doesn't happen during the dark reactions?.......
 - a CO₂ fixation.

- **b** NADPH, oxidation.
- © Photosynthetic phosphorylation.
- d ATP consumption.
- The following figure shows a model for the transport process of organic substances in the plant:

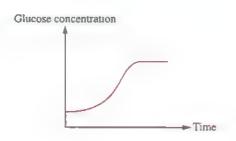


Which of the following describes the structures from (Y): (Z) and the correct direction for the transport process through the structure (W)?......

	Phloem	Xylem	Roots	Leaves	Transport direction
a	W	X	Y	Z	Z-→Y
b	W	X	Z	Y	Y Z
0	X	W	Y	Z	Y → Z
(J	Х	W	Z	Y	Z → Y



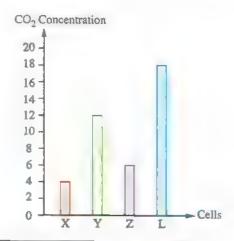
- From the opposite figure, which of the following blood vessels is represented in the graph? ...
 - a Pulmonary artery.
 - b Hepatic portal vein.
 - © Heaptic vein.
 - d Hepatic artery.



- When we put the RBCs in a salt solution of unknown concentration for a period of time, the cells shrink, from the previous we can deduce that
 - (a) the concentration of salts in the solution is less than their concentration in the blood cells.
 - b the concentration of salts in the solution is more than their concentration in the blood cells.
 - c the concentration of salts in the solution equals to their concentration in the blood cells.
 - d None of the previous.
- The opposite graph represents the amount of CO₂ released during the aerobic respiration process, in which cell do three glucose molecules are oxidized completely?

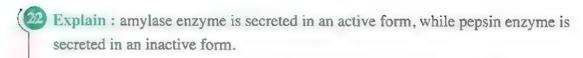


- **(b)** (Y).
- © (Z).
- (d) (L).



- Which of the following doesn't agree with glycolysis reactions and the reactions that occur in the chloroplast grana?.....
 - a Both of them need energy.
 - **b** Both of them produce ATP molecules.
 - © Both of them linked with the presence of co-enzymes.
 - d In both of them a 3 carbon compound is formed.

Answer the following questions (22:27):



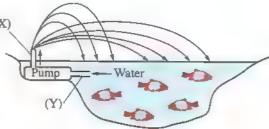
- What happens in case of: the deposition of cutin on the external walls of the root hairs?
- Calculate: the number of ATP molecules which is resulted from the oxidation of 10 glucose molecules inside a seed of a dicot plant at the beginning of the germination process.
- "The speed of food substances transport in the plant depends on some of external factors". How far the statement is correct? With explanation.
- The opposite diagram illustrates a conversion in a muscular cell in the body, where the concentration of the compound (M) increases during the muscular fatigue, what is the purpose of the step no. (2)?





In the opposite figure, the lake is supplied with the atmospheric oxygen through an external source to reach the fish, (X) if you know that the work of this pump is similar to the work of the heart in the human blood circulation. What are the blood vessels that are similar to the work of each

of (X) and (Y)?



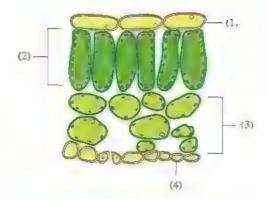
Choose the correct answer (1:21):

- - (1).

(2).

© (3).

(d) (4).



- Which of the following happens in the case of presence or absence of oxygen?.....
 - a Glycolysis.
 - (A). The conversion of pyruvic acid into acetyl coenzyme
 - © Citric acid cycle.

- d Oxidative phosphorylation.
- - the concentration of the starch molecules in the second minute is lower than that in the fourth minute.
 - b the concentration of glucose in the fourth minute is higher than that in the first minute.

 the concentration of maltose in the second minute is higher than that in the fourth minute.
- The reaction products

 60

 40

 20

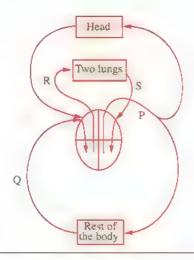
 Time

 0 1 2 3 4 5 6 (minute)
- d the concentration of maltose in the fourth minute is higher than the concentration of starch.
- Which of the following percentages are equal?........
 - .. The percentage of O2 in the inhaled air with its percentage in the alveolar air.
 - The percentage of CO₂ in the exhaled air with its percentage in the alveolar air.

 The percentage of N₂ in the inhaled air with its percentage in the exhaled air.
 - .. The percentage of H₂O in the inhaled air with its percentage in the exhaled air.



- The opposite figure represents the heart and the main blood vessels, which of the following blood vessels has the highest blood pressure?
 - (a) R
 - (b) S
 - C P
 - (d) ()



- The green plant is autotrophic", "it absorbs water and glucose from the soil",
 - (a) the two statements are correct and related.
 - b the two statements are correct and not related.
 - the first statement is correct and the second statement is wrong.
 - the first statement is wrong and the second statement is correct.
- § If 30 molecules of NADH are transferred from Krebs cycle to the electron transport. chain, the number of pyruvic acid molecules which entered into the mitochondria to participate in the reactions is molecules.
 - (a) 5

(b) 10

© 15

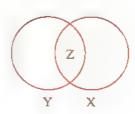
- (d) 20
- 8 Which of the following elements is not present in the food of aphid insect, when it is examined?
 - (a) Amino acids.

(b) Fatty acids.

© Sucrose.

- (d) Water.
- The opposite figure illustrates two types of the body fluids, if you know that (Y) contains enucleated cells, what do you expect about the components of the fluid (Z)?.....

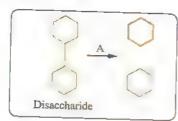
 - (a) Plasma and white blood corpuscles.
 - b Lymph and plasma.
 - C Lymph and white blood corpuscles.
 - Red blood corpuscles and blood platelets.

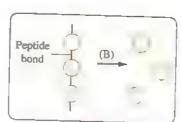


- The green plants differ from the purple sulphur bacteria in
 - a the type of chlorophyll in each one of them only.
 - the hydrogen source which is required to fix CO2 in each one of them only. the type of chlorophyll and the source of hydrogen required to reduce CO2 in each one of them.

the green plants are autotrophic, while purple sulphur bacteria are saprophytes.

- All the following vital processes need ATP, except ...
 - a aerobic respiration.
- (b) glycolysis.
- anaerobic respiration. J H₂O splitting in photosynthesis process.
- "After eating too much salty popcorn we feel roughness in the internal side of lips". What is the reason for that?....
 - . Entrance of salt into the lips' cells that leads to their swelling.
 - b Exit of salt from the lips' cells that leads to their shrinkage.
 - Entrance of water into the lips' cells that leads to their swelling.
 - Exit of water from the lips' cells that leads to their shrinkage.
- Study the following diagram, then answer the following question:





What is the suitable value of pH for the activation of (A) and (B) enzymes together?

(a) 6

- The blood vessel which contains the greatest percentage of fats after digestion and absorption processes ?
 - Superior vena cava.

(b) Inferior vena cava.

C Hepatic portal vein.

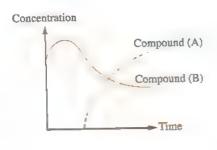
d Hepatic vein.



The opposite graph represents the concentration of two types of compounds in the thigh muscles, during practicing vigorous exercise, which of the following expresses (A) and (B)

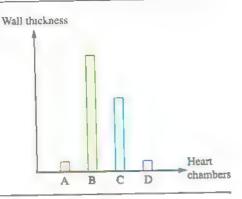
respectively?.....

(a) ADP, Glucose. Glycogen, ATP. (b) Lactic acid, Glucose. Glycogen, Lactic acid.



Study the opposite graph, which shows the difference in the thickness of heart chambers in human, then determine which chamber represented by column (B)

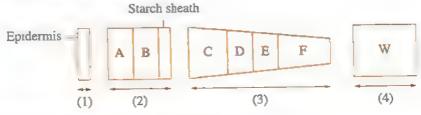
- (a) right atrium.
- b left ventricle.
- c) left atrium.
- d right ventricle.



Which of the following expresses the characteristic features of the structures which found in the cotton plant leaf's phloem?

	Solutes concentration in the cell	Precipitation of lignin in the cell walls
a	Low	Low
b	Low	High
`	High	Absent
d	High	High

18 Study the following diagram which shows 4 parts in the stem of a dicot plant, arranged from outside to inside, then determine:



What is the function of each of (F) and (D) tissues?

a Aeration.

(b) Elasticity.

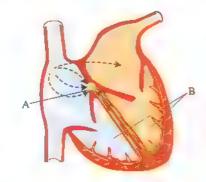
© Sap storage.

(d) Sap transfer.

organisms, in which do these processes tal	n shows some vital inside some living of the following organis see place?	ims	Glucose
a Chlorella alga.		. /	
© Bilharzia woппs.		ATD .	Energy
Which of the following epidermis?	ng plants, do you expect	t the absence of cutin f	rom its leaves
a Bean.	6 Corn.	© Elodea.	d Cactus.
Which of the following	g compounds, its defici	iency affects the rate o	f respiration and
photosynthesis proces	ses in Elodea plant?	771211000	- 100pration and
a ATP	(b) FAD	© NAD+	(d) NADP
			Limewater Ro
Explain: in the plant,	water transfers faster at	(X)	(Y)
Explain: in the plant,	water transfers faster at	(X)	(Y)
Explain: in the plant,	water transfers faster at	(X)	(Y)
	water transfers faster at	noon and slower at ni	(Y)



The opposite figure illustrates a longitudinal section in the human heart and the arrows represent the direct movement of the electric pulse which makes the muscle starting to contract.

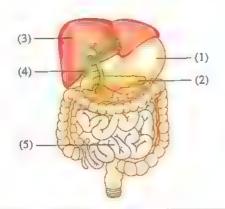


Illustrate:

- (a) The reason for the delaying in passing of the electric pulse that occurs at the point (A).
- (b) The importance of contraction of (B) from the base.
- "The aerobic respiration may occur after the anaerobic respiration".

 How far the statement is correct? With explanation.

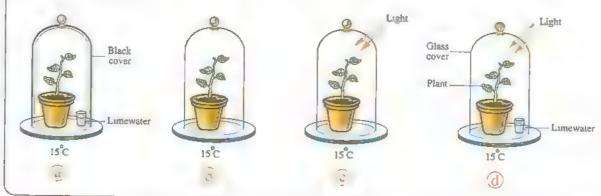
- The opposite figure illustrates a part of the human digestive system, write the number and the name of organ:
 - (a) That is responsible for the adjustment of pH value in the organ no. (5).



(b) That contains the highest concentration of hydrogen ions.

Choose the correct answer (1:21):

In which of the following figures can the plant perform the photosynthesis process?



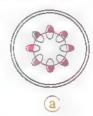
- Which of the following doesn't agree with glycolysis and the reactions which occur in the grana of the chloroplast?.....
 - a Both of them need energy.
 - b ATP molecules are released from both of them.
 - © Their occurrence is linked to the presence of coenzymes.
 - d 3-carbon compound is formed in each one of them.
- After performing a muscular effort, which of the following blood vessels carries the lowest concentration of CO₂?.....
 - a Hepatic vein.
 - b Pulmonary artery.
 - © Pulmonary vein.
 - d Vena cava.
- If a molecule of maltose is completely oxidized, the number of CO₂ molecules which is resulted from Krebs cycle is
 - (a) 2

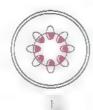
b 4

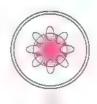
- © 6
- **d** 8



A plant was put in water containing red dye for 24 hours, then it was removed, and several sections were taken from the plant stem, which of the following figures illustrates that?

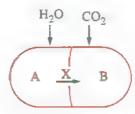




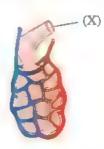




- In the opposite figure, which of the following represents (X)?..........
 - (a) ATP and PGAL
- (b) ADP and CO,
- © H₂O and NADP
 - (d) NADPH, and ATP



- The pulmonary artery contains the highest percentage of
 - a oxyhaemoglobin.
 - b carbo-aminohaemoglobin.
 - haemoglobin.
 - d haemoglobin and oxyhaemoglobin.
- In which of the following stages the least amount of ATP molecules are released directly?
 - a Glycolysis.
 - **b** One Krebs cycle.
 - © Electron transport chain.
 - d Krebs cycle and electron transport chain.
- The part (X) represents
 - a main branch from the trachea.
 - b a branch from a blood vessel.
 - © an alveolus.
 - d a bronchiole.



(10) The organ which secretes digestive juices for all types of food is the (a) stomach. b liver. c pancreas. duodenum. The substance(s) that form(s) the greatest portion of lymph is/are a water. (b) fats. c proteins. monosaccharides. 12 The ratio between the amount of energy produced from ATP molecule and that produced from NADH molecule is (a) 1:3 **b** 2:1 C1:1 (d) 3:113 Study the opposite graph which shows Amount of the route of (100 g) of a nutrient material (X) through different digestive organs after more 100g. than 1 hour of its ingestion. What is the form of (X) when it is transferred through the villi of 50g small intestine?..... a Glycerol. (b) Monosaccharides. Digestive Mouth Stomach Small system organs © Fatty acids. d Amino acids.

Potato slices of equal length were put in serial concentrations of sucrose sugar for 30 minutes, their length were measured before and after putting, the following graph shows the ratio between the length before and the length after and solution concentration. Which of the following shows the change in the length of potato slices and the pressure of fullness with water with increasing the concentration of sugar solution?....

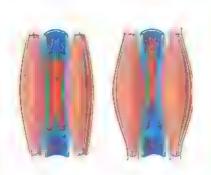
the length before (cm)	_
The length after	Th
4	4
1.4 -	1.4 -
1.2-	1.2-
1.0-	1.0 -
0.8-	0.8 -
0.6	0.6
0.4 Concentration	0.4
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 (%)	0.

	The change in length	Pressure of fullness with H ₂ O
a	Increases	Increases
b	Increases	Decreases
0	Decreases	Decreases
	Decreases	Increases





- 15 From the opposite figures, the role of muscles surrounding the veins is
 - (a) opening of the valve when the muscles contract.
 - b opening of the valve when the muscles relax.
 - closure of the valve when a muscle contract and its opposite relax.
 - d opening of the valve when a muscle contract and its opposite relax.





- Study the following pathways:
 - Alveolus \longrightarrow O_2 \longrightarrow Blood capillaries.
 - Small intestine —— Amino acids —— Blood capillaries.
 - Atmospheric air --- CO₂ --- Plant cells.

What is the common mechanism in transferring the substances in the previous pathways?.....

- a Active transport.
- **b** Osmosis.
- © Diffusion.
- d Imbibition.



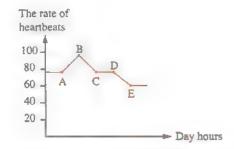
The Study the opposite graph which shows the heartbeats rate for a person during the day, then determine the interval time that represents practicing a physical activity

(a) AB

(b) DE

C BC

(d) CD



18 Which of the following substances isn't formed in the liver?

- Bile juice.
- © Glycogen.

- **b** Heparin.
- d Lipase enzyme.

19 If the energy produced during aerobic oxidation of a glucose molecule equals 2880 KJ. So, the expected energy produced from a glucose molecule in a skeletal muscle during anaerobic respiration equals about KJ.

(a) 75

b 150

© 300

(d) 450

(20) Study the following table:

Substance	Concentration in Villus	Concentration in transporting vessels
Na ⁺	155 mg / 100 ml	15 mg / 100 ml
Glycine	0.02 %	0.1 %
H ₂ O	75 %	70 %
Cl ⁻	1.01 mg / 100 ml	1.5 mg/ 100 ml
Fat droplets	0.33 %	0.35 %

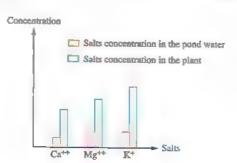
Which of the following substances will be transferred to the transporting vessels by the same phenomenon?........

- a Na+ and Cl-
- C H2O and glycine.

- (b) H₂O and fat droplets.
- d Glycine and Cl

From the opposite graph, we can deduce that the salts absorbed by the plant through phenomenon / phenomena.

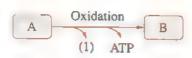
- (a) diffusion
- **b** permeability
- c active transport and permeability
- d cation or anion exchange



Answer the following questions (22:27):

Write the scientific term: "Non-living plant structures, whereas the shape of their inner surface changes from a plant to another".

From the opposite diagram, if you know that (A) and (B) are intermediate compounds which are formed through one of the cellular respiration stages inside the mitochondria and each one of them consists of the same number of carbon atoms, what is the name of the product no. (1)?





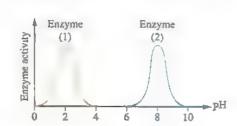
Explain: the glycolysis process needs energy.

If you know that the saline solution which is given through a venous injection, its concentration is 0.9%, deduce what happens to the red blood corpuscles when the concentration of the saline solution is 1% or 0.7%. Explain your answer.

"The blood flow factors differ in the artries from the veins".

How far the statement is correct? With explanation.

The opposite graph illustrates
the activity of two enzymes that affect
the same food substance, deduce
the name of the two enzymes (1) and (2).



Choose the correct answer (1:21):

- The two valves which allow the blood to pass at the same time are
 - a mitral valve and pulmonary valve.
 - b pulmonary valve and aortic valve.
 - © mitral valve and aortic valve.
 - d tricuspid valve and aortic valve.
- Which of the following conversions includes the oxidation process of coenzymes?...
 - (a) Pyruvic acid from phosphoglyceraldehyde.
 - b Succinic acid from ketoglutaric acid.
 - @ Malic acid from succinic acid.
 - d Lactic acid from pyruvic acid.

Salt	The length of the slice
solution	after 30 minutes
(a)	4.5
(b)	4.8
©	5
Ţ.	5.3

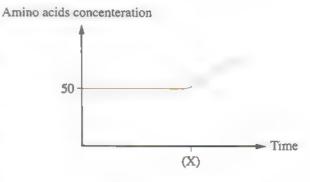
- Which of the following represents the correct arrangement of the stem tissues from inside to outside?.....
 - Epidermis Cortex Vascular bundle Pericycle.
 - b Vascular bundle Pericycle Cortex Epidermis.
 - © Vascular bundle Epidermis Cortex Pericycle.
 - d Pericycle Epidermis Vascular bundle Cortex.

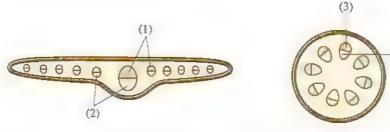


- A green potted plant was placed on a glass plate and a small beaker containing clear limewater was put next to it under the bell-jar, and they were left a period of time exposed to light, we observe that
 - a the limewater becomes turbid.
 - the limewater becomes turbid, then the turbidity disappears.
 - c the limewater is clear.
 - d the colour of limewater changes into dark red.
- - a one.

- b two.
- c three.
- d four.

- In the opposite graph, which of the following enzymes is responsible for the change in the concentration of amino acids in the hepatic portal vein at the point (X)?
 - a Lipase.
- (b) Amylase.
- © Peptidase.
- d Pepsin.





- (1) and (3).
- (b) (2) and (4).
- © (2) and (3).
- (1) and (4).

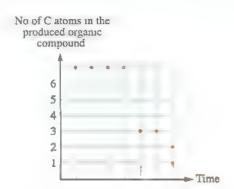
a fibrin.	b thromboplastin.
© thrombin.	d fibrinogen.
In the presence of acety	l groups, Krebs cycle may occur in the absence of all of
the following, except	
a glucose.	b oxygen.
© respiratory enzymes.	(d) ATP molecules.
Which of the following foo	d substances wouldn't be discussed if it
	d substances wouldn't be digested, if it was treated with present in the pancreatic duct?
(a) Meat.	(b) Penaut butter.
© Bread.	d Rice.
the sieve tubes of phloem". best?	stances like sugar cane and amino acids transfer through Which of the following statements describes this
best? a Sugar transfers by active diffusion in the other sie	Which of the following statements describes this transport in some sieve tubes, while amino acids transfer two tubes.
best? a Sugar transfers by active diffusion in the other sie	Which of the following statements describes this e transport in some sieve tubes, while amino acids transfer l
best? Sugar transfers by active diffusion in the other sie Sugar and amino acids to phloem.	Which of the following statements describes this transport in some sieve tubes, while amino acids transfer two tubes.
best? Sugar transfers by active diffusion in the other sie Sugar and amino acids to phloem. The rate of sugar and amino acids to the same sieve tube of phloem.	Which of the following statements describes this e transport in some sieve tubes, while amino acids transfer to eve tubes. ransfer together by active transport in the same sieve tube of nino acids flow increases in two different directions in hloem.
best? Sugar transfers by active diffusion in the other sie Sugar and amino acids to phloem. The rate of sugar and amino acids to the same sieve tube of phloem.	Which of the following statements describes this e transport in some sieve tubes, while amino acids transfer to tubes. ransfer together by active transport in the same sieve tube of the companion acids flow increases in two different directions in thosem. Inino acids flow increases in different directions of different directions direction



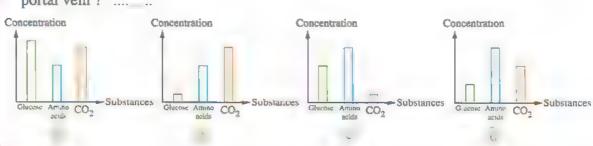
- The opposite graph represents the organic compounds which are formed during cellular respiration inside the cell cytoplasm in case of O₂ defeciency, which of the following performs this type of respiration?............
 - a Paramecium.
- **b** Bacteria.

© Euglena.

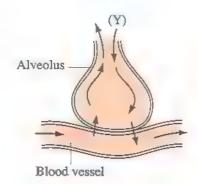
d Yeast fungus.



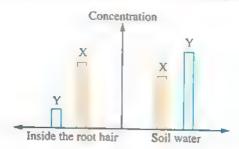
Which of the following graphs describes the substances concentration in the hepatic portal vein?



- Some soil fungi cause wilting diseases to some crops, whereas they attack the xylem vessels and grow inside them", which of the following vital processes will be affected by these fungi?
 - (a) Cohesion force between H₂O molecules.
 - Adhesion force between H₂O molecules and walls of xylem vessels.
 - © The flow rate of solutes during transmission.
 - d The absorption rate of H₂O through the root hairs.
- When (Y) combines with haemoglobin in the red blood cell in the two lungs substance is formed.
 - a protein
 - **b** iron
 - carbo-aminohaemoglobin
 - d oxyhaemoglobin



The following graph shows the concentration of (X) ion and (Y) ion for elements needed by a plant, in the soil and inside the root hair of this plant:



What are the phenomena that lead to (X) . (Y) transfer respectively ?

- a Active transport and diffusion.
- **(b)** Selective permeability and active transport.
- © Diffusion and selective permeability.
- d Selective permeability and diffusion.
- If we can take half the amount of pyruvic acid after glycolysis of 10 glucose molecules, the number of produced ATP after electron transport chain is ...
 - a 190

(b) 180

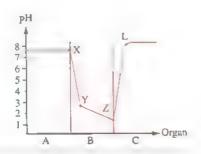
© 150

- **d** 170
- If you put a plant cell in a sucrose solution whose concentration is more than the cell osmotic pressure. So, it will
 - (a) swell, due to H₂O entrance inside its sap vacuole.
 - b shrink, due to H2O exit from its sap vacuole.
 - o not change.
 - d brust.
- Presence of 6 molecules of CO₂ during the aerobic cellular respiration indicates that
 - a glycolysis occurs.
 - b two Krebs cycles occur.
 - © complete oxidative phosphorylation occurs.
 - d the cell consumes more O,



Answer the following questions (22:27):

- Explain: the leaves represent the production lines, while the phloem tissue represents the distribution lines in the plant.
- What is the relation between: the red blood cells and facilitating the digestion of fats?
- Suggest one reason for : stopping the reactions of electron transport chain.
- The opposite graph illustrates three organs in the digestive canal A, B and C, illustrate the substance which is responsible for the change in pH from:
 - (a) The point (X) to point (Y).
 - (b) The point (Z) to point (L).





(26) The opposite table illustrates

relative percentages in the inhaled air, the exhaled air and the residual air in lung (the air in alveoli).

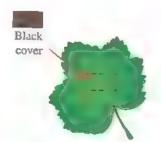
	Inhaled air	Exhaled air	Alveolar air
O ₂ %	21	16	14
CO ₂ %	0.03	4	5.5

Explain how the differences occur in these components according to what happens in the two lungs.



27 In the opposite figure a black cover was put on the part (X) then the leaf was exposed to the light for several hours.

Conclude what happens if some drops of iodine solution are put on the parts (X) and (Y), after removing the black cover.

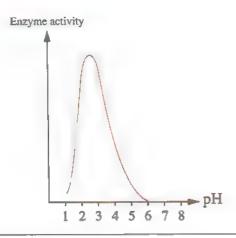




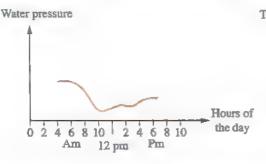
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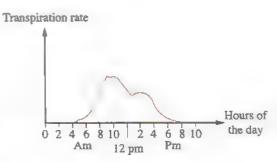
Choose the correct answer (1:21):

- The opposite graph shows the effect of pH on the rate of a digestive enzyme activity, this enzyme is found mainly in
 - a bile.
 - b gastric juices.
 - c intestinal juices.
 - d pancreatic juices.



- All the following produce an equal number of ATP molecules, except
 - (a) FADH, molecule in the electron transport chain.
 - (b) the acidic fermentation.
 - © the alcoholic fermentation.
 - done Krebs cycle.
- The two following graphs illustrate the rate of the transpiration process and the water pressure in the plant leaf cells, within the day hours:

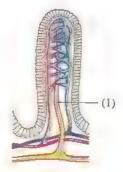




From the previous figures, it can be concluded that

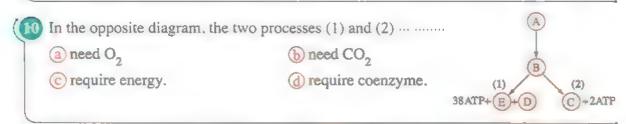
- the water pressure decreases inside the leaf cells with increasing the transpiration process.
- the water pressure increases inside the leaf cells with increasing the transpiration rate.
- the stomata of leaf closes at 10 am.
- d the stomata of leaf opens at 4 am.

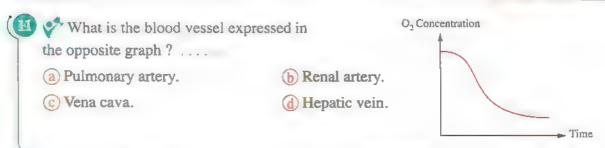
- A blood sample was taken from a blood vessel in the patient body, on examining its external appearance, it was found that its colour is light red. So, it is expected that this sample is taken from
 - a blood vessel near to the skin surface.
 - b a blood vessel buried among the muscles.
 - © blood capillaries near to the skin surface.
 - d blood capillaries buried among the muscles.
- If the stored energy is not released from the coenzymes during the electron transport chain, the number of ATP molecules which are resulted from the oxidation of one molecule of glucose aerobically is molecules.
 - a 3
 - **b** 4
 - (c) 8
 - d) 16
- The process that occurred in chloroplast and is opposite to the process of the photosynthetic phosphorylation is the production of
 - (a) ATP from ADP in the grana.
 - (b) ADP from ATP in the grana.
 - O ATP from ADP in the stroma.
 - (d) ADP from ATP in the stroma.
- Which of the following does the decrease of its production rate lead to a decrease in food substances that are transferred to the structure no. (1)?
 - a Bile juice.
 - Pepsin.
 - © Amylase.
 - d Sucrase.





- In each of the alcoholic fermentation and the acidic fermentation, 2 molecules of ATP are released. So, it is expected that the number of the kilocalories resulted from the lysis of the released ATP molecules
 - from the alcoholic fermentation is greater than that from the acidic fermentation.
 - from the alcoholic fermentation is lower than that from the acidic fermentation.
 - c is equal in the two types of fermentation.
 - d there is no fixed relation.
- Which of the following statements doesn't illustrate the transport process of water in the plant?
 - Most of the released water from the leaf gets out through the stomata.
 - The cohesion between the molecules of water causes the presence of a continuous column of water.
 - The effect resulted from the transpiration process causes the presence of the continuous attraction of water column upward.
 - The adhesion force between molecules of water and xylem vessels causes the column of water to be held continuously.





- During preparation of a T.S. of a new dicot plant stem, iodine was added to the stem sample to enhance the examination, which tissue do you expect its cells won't be pigmented with the dark blue colour?............
 - (a) Cambium.

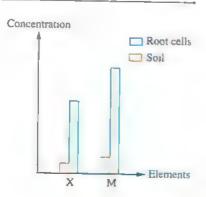
- (b) Cortex.
- © Medullary rays.
- d Pith.

13 What is the mechanism of absorption for the products of starch digestion?

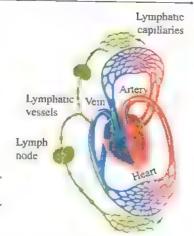
- a Active transport to the arterioles (arterial capillaries).
- b Active transport to the lacteal vessel.
- © Diffusion to the lacteal vessel.
- ① Diffusion to the venules (venous capillaries).
- 14 Study the opposite graph which shows the plant need for (X), (M) elements to perform vital processes, what is the factor that help in increasing the concentration of (X) and (M) inside the root cells?



- b Decreasing of sugar inside sap vacuoles of root cells.
- © Decreasing of O2 inside root cells.
- d Plenty of O, inside root cells.



- The opposite figure shows the relation between the lymphatic system and the circulatory system, we can deduce that
 - a both of them are closed systems.
 - both of them are opened systems.
 - circulatory system is closed, while lymphatic is opened.
 - d circulatory system is opened, while lymphatic is closed.



- When eating a meal contains bread, rice and potatoes, what is/are the enzyme(s) that will digest all these food substances?.....
 - (a) Amylase only.
 - b Lipase only.
 - © Amylase and lipase.
 - d Lipase and peptidase.

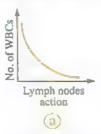


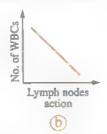


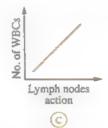
- a) more than
- (b) less than
- c equals to
- d. No correct answer

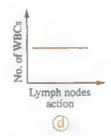


Which of the following graphs represents the immunity performance for a person body in the first days of a bacterial infection?..........









In your opinion, why NADH gives 3 ATP molecules, while FADH₂ gives 2 ATP molecules only?.......

NADH gives its electrons to the cytochrome at higher energy levels.

FADH, gives its electrons to the cytochrome at higher energy levels.

- © NADH doesn't give all its electrons to the cytochromes.
- FADH₂ doesn't give all its electrons to the cytochromes.

Which of the following is permeable to water?......

- (a) Cellulose walls.
- (b) Lignin covered walls.
- © Cutin and suberin covered walls.
- d Plasma membranes and cellulose walls.

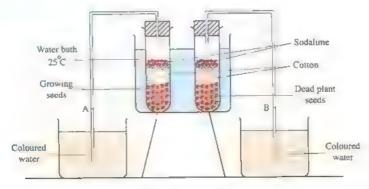
president and the state of the	same length were put in a serial
on of sucrose sugar, their length wen	re measured before and after
opposite graph shows the rate	
n length, which of the following	The length before (cm)
ons for sucrose solution has the same	e 1.04
on of cellular sap of the plant before	107
the sugar solution ?	1.00
	0.98 -
	0.96
	0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8
	Sugar solution concentration (%)
e competition.	ns reach about 180 beats/minute at
e competition.	ns reach about 180 beats/minute at
ens in case of: the exposure of the p	plant to an infection with a microbe a
e competition.	plant to an infection with a microbe a
ens in case of: the exposure of the p	plant to an



"The respiration rates may increase in the root hair during the absorption of the mineral salts". How far the statement is correct? With explanation.

The doctor may recommend a medicine for the patient, that is taken through venous injection not by the mouth. Suggest two reasons for that.

(27) From the following figure:



Deduce what happens in each level of (A) and (B) after passing a period of time. **Explain your answer.**



BIOLOGY

By A Group Of Supervisors



GUIDE ANSWERS



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Answers of Chapter One

Lesson



Answers of Multiple Choice Questions

- 🚺 📵 (a) and (c).
- © high-energy and complex-structured
- © obtain their food in the form of simple -structured compounds
- (A), (B) and (C).
- 5 d parasites.
- (b) bread mould fungus.
- (a) increase of its surface area
- (C) elongation zone
- 10 6 Calcium salts. (a) endosmosis
- **1** (2). 11 (b) diffusion.
- 13 © Water will transfer from left to right.
- [4] (a) The first is 6 g and the second is 4 g.
- **15** @ (3), (2) , (1).
- 16 © 7% and 2%
- 17 @ cell no. (4) to cell no. (1).
- 18 (d) (4).
- 19 ® osmosis. (2) (a) osmosis.

(C) proteins

26 © lodine

- 20 (1) (b) diffusion The cell bursts
- ab, cellulose
- c osmosis
- 🔼 🖟 Nitrogen.
- (A) only.
- 2 d) 2 f x 103
- (2) (b) diffusion.
- [29] (1) © the plant doesn't need it. (3) © active transport.
 - (4) (a) mon (5) (a) the plant needs the element (Y) more than
- 30 (d) concentration of solution (M) equals to that of the solution inside the sap vacuoles of (Y)
- (1) (b) (Y) / solution (1) to solution (2). (2) © first / 7

Second Answers of Miscellaneous Questions

As the cotton plant is from the green plants that manufacture their food by themselves, whereas it synthesizes the high-energy and

complex-structured organic food substances from the simple-structured, raw and low-energy inorganic materials inside its cells through the photosynthesis process, while the bread mould fungus obtains the high-energy organic food substances from the bodies of other living organisms by saprophytism.

Bean plant	Orobanche plant
Antotrophic living organism.	Hescrotrophic living organism.
 It obtains its food by chemical reactions that occur inside its cells and are known as "photosynthesis". 	It obtains its food from the bodies of other living organisms by parasiusm

- (3) As the plasma membrane of plant cell prevent the permeability of sugar molecules from the soil, while its cell wall permit water and salts ions only to pass, where they are used by the plant in the formation of sugars inside its cells through the photosynthesis process.
- (a) It may lead to the tearing of each of the structure no. (1) "piliferous layer (epidermis)" and the structure no. (3) "root hair" and compensation occurs community from the elongation zone in the root.
 - (b) The concentration of ions will increase inside the structure no.(2) "sap vacuoles", leading to the transfer of water by osmosis from the soil to the structure no. (3) "root hair", then to the epidermal cells in the root.
 - (c) The surface area of water and salts absorption from the soil decreases, as well as the fixation of plant in the soil decreases, due to the mability of penetration and stick among the soil particles which may lead to the death of plant.
- As the concentration of solution (cellular sap) inside its sap vacuole is higher than the concentration of soil solution. This helps water to pass from the soil to the cell by osmosis.

- (a) (1) Soil particles.
- (2) Root hair
- (3) Piliferous layer "epidermis",
- (4) Xylem vessels.



- (c) 1. As the structure no. (2) "root bair" secretes a viscous substance to help it to find its way easily among the structure no. (1) "soil particles" and stick to them, and so it can fix the plant into the soil.
 - 2. As the structure no. (2) "root hair" is characterized by:
 - Being large in number and protruding to outside to increase the surface area of water and salts absorption.
 - · Having thin wall to permit the passage of water and salts through it.
 - The solution inside its sap vacuole is more concentrated than the soil solution to help water to pass from the soil to the root hair
- (d) The synthesized carbohydrates will not be converted into proteins.
- (e) The water molecules will replace oxygen, therefore there will be a difficulty for the plant to absorb oxygen by the root hairs which affect the absorption of some mineral salts from the soil by active transport, due to the absence of ATP molecules, as a result of the shortage of the oxygen gas that is required for respiration process.
- 7 The statement is wrong / As the call walls consist mainly of cellulose that is permeable to water and mineral salts.
- (a) 2% / Because the solution level inside the funnel no. (2) that contains starch solution (2%) doesn't change after passing 24 hours.
 - (b) The level of solution inside the funnel no. (3) that contains starch solution (4%) will increase, while that of solution inside the funnel no. (1) that contains tap water will decrease, due to the transfer of water

through the semi-permeable membrane by osmosis phenomenon from the medium with high concentration to the medium with low concentration for the water molecules.

- 9 (a) 1, 90% 2,80%

3.0%

(b) (1) the water doesn't move, because the concentration of the solution inside the cellulose sac is equal to its outside



(2) the water moves from the outside of the cellulose sac to its inside by osmosts phenomenon, because the water moves from the medium with high concentration of water molecules to

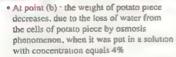


the medium with low concentration of water molecules

(3) the water moves from the inside of cellulose sac to its outside by osmosis phenomenon because the water moves from the medium with high concentration of water molecules to the medium with low concentration of water molecules.



- 10 (a) The concentration of 10% sucrose, due to the transfer of water from the cell sap vacuole to its outside by osmosis. So, the size of the cell sup vacuale decreased and the cell shrank.
 - (b) Water will pass from outside of the cell to its inside by osmosis. So, the cell sap vacuole will be filled with water and the cell returns to its original shape "cell no. (1)".
- (a) At point (a) : the weight of potato piece increases, due to the transfer of water to the piece of potato by osmosis phenomenon. when it was put into a solution with concentration equals zero (water).



- (b) The concentration (2%), because the weight of potato piece (7g) remains constant
- (c) Because the potato piece loses all the amount of water that presents inside the sap vacuoies of its cells by osmosis.
- The water transfers from the sap vacuoles of the plant cells to the soil by osmosis phenomenon (i.e. from the medium with high concentration of water to the medium with low concentration of water), leading to the plant wilting after passing several hours of its irrigation with a highly concentrated salt solution
- The relation is directly proportional (i.e. the osmotic pressure increases by increasing the concentration of solutes in the solution) So, water can pass from the low-concentrated solution to the high-concentrated solution by osmosis.
- 15 The statement is wrong / Because the osmotic pressure is arisen from the difference in osmosis among the plant cells, where water moves from the cells with high concentration of water to the cells with low concentration of water as a result of the presence of difference in solutes concentration in water on the two sides of membrane
- [5] (a) The plant cell swells. (b) The animal cell bursts
- 16 To force the ions to diffuse against the concentration gradient which is knows as the active transport, as the concentration of these ions inside the cell is higher than their concentration outside the cell
- In tube no.(1), the seedling appears yellow m colour, because the nutritive solution doesn t contain the essential elements (macro and micro-nutrients) that are needed by the seedling for growth, while in tube no.(2), the seedling appears green in colour, because the nutritive solution contains the essential elements needed by the seedling for growth

- T Organism (X): belongs to the autotrophs.
 - Organsim (Y): belongs to the parasitic heterotrophs.
 - Organsim (Z) belongs to the saprophytic heterotrophs

Lesson

Answers of Multiple Choice Questions

- d chlorenchymatous
- ₽ в О,
- **3 CO**,
- Z a cutin
- (1) a (1)
- a Palisade tissue
- 📑 c splitting of hydrogen sulphide and formation
- 6 12
- 1066
- 11 (1) (6) (2).
- (2) (6) (2).
- (3) (2) & (4).
- (4) (6) (2)
- 12 © layer that is impermeable to water.
- 13 (a) 6CO2 + 6H2O 402 + C6H12O6 + 6O2 T
- 14 © the light intensity is very low.
- 15 d energy to produce oxygen, water and glucose.
- 16 (b) Glucose.
- C Oxygen
- TE (6) A+C -Section B+D
- C chlorophyll molecules.
- (a) light reactions only
- 21 (b) dark reactions
- (d) ADP from ATP in stroms.
- 🔁 © light + chlorophyll + ADP
- 24 © CO2 gas will not be fixed.
- 25 © (a) and (b) respectively
- **1 (b)** fixation of carbon dioxide.
- C ATP
- 23 (1) (b) H₂O
- (2) (b) ADP
- (3) (a) NADPH,
- (4) (a) grana / stroma
- 29 (a) NADPH, and ATP
- 30 d formation of simple sugars.

- 🛐 🚳 grana and stroma together
- © formation of ADP
- (a) formation of a 3-carbon compound.
- (1) combination of carbon dioxide with hydrogen.

4 · a 2

23 c O2

d C6H 2O6 Ç

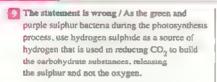
a

- 110 To From light to chemical / Glucose / Starch 7 b (B)
- © resulted from the photosynthesis process.
- (5 d) soda water makes the soil moist and the leaves of plant absorb CO2, increasing the rate of plant growth.
- [[] (1) (d) (d) to (e). (2) (a) C6H12O6

Second Answers of Miscellaneous Questions

- Because it contains chlorenchymatous tissues that contain chloroplasts,
- (a) Chlorophyll (A), chlorophyll (B), xunthophyll and carotene
 - (b) As the ATP and NADPH, compounds that are formed in structure no. (5) "grana" during the light reactions are carried to the structure no. (1) "stroma" for the occurrence of dark reactions, where carbon thouse gas is fixed by its combining with hydrogen that carried on NADPH2 compound by the help of the stored energy in ATP molecule, leading to the formation of carbohydrates.
 - (c) 1. (3) DNA
- 2. (1) Stroma.
- 3 (4) Strach granules
- [3] (a) The structure no. (9) "palisade tissue" consists of one row of cylindrical and elongated parenchyma cells that are perpendicular to the surface of upper epidermis, and they possess many chloroplasts to receive the largest amount of light, as well as the elongation of their cells allows the chloroplasts to move away or toward the upper surface of the leaf. according to the light intensity

- (b) 1. (3) & (11) / The cells of structure no. (3) "xylem vessels" (non-living cells) participate with the cells of structure no. (11) "xylem parenchyma" (living cells) in the formation of xylem tessue (compound tissue)
- 2. (8) & (9) / The parenchyma cells of structure no. (8) "spongy tissue" participate with the parenchyma cells of structure no. (9) "palisade tissue" in performing the photosynthesis process, as they contain chloroplasts.
- (c) The structure no. (7) differs from the structure no. (10) in the number of stomata, as the number of stomata in the structure no. (7) "lower epidermis" is higher than their number in the structure no. (10) "upper epidermis".
- The plant will die, due to the non-occurrence of photosynthesis process, because of :
 - The non-occurrence of the light reactions. due to the absence of chlorophyll needed for absorbing the light energy.
 - The non-occurrence of the dark reactions, due to the non-formation of ATP and NADPH, that are required for the fixetion of CO, gas and formation of carbohydrates
- 5 Answer by yourself
- The absorption of plant to light energy will not take place. So, the photosynthesis process will not occur, because it is believed that the presence of magnessum atom is essential for chlorophyll synthesis and so the plant will die
- As the upper surface of leaf is followed by the palisade tissue whose cells contain a large number of chloroplasts, while above the lower surface there is the spongy tissue whose cells contain a smaller number of chloroplasts than the palisade tissue cells.
- The plant will die, due to inability to translocate the dissolved organic food substances from the mesophyll tissue where they had been manufactured to the different parts of the plant.



(a)

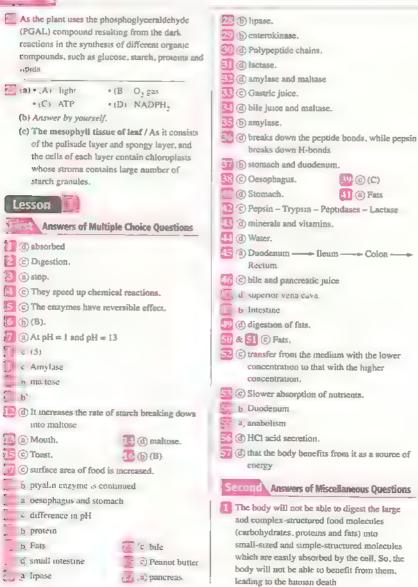
The mistake	The explanation
Using pure water.	It doesn't contain a source of salts needed for the plant to perform the photosynthesis process.
The absence of a source for CO ₂ gas.	The plant will not be able to perform the photosynthesis process and form the carbohydrate substances.
The evolving of gas bubbles in the glass tube.	The plant didn't perform the photosynthesis process, therefore O ₂ gas wouldn't evolve.

- (b) 1. The photosynthesis process will not occur / As most types of bacteria are heterotrophic organisms, and the others are autotrophic, such as the green and purple sulphur bacteria, but they need the hydrogen sulphide instead of water to perform the photosynthesis process.
 - The aquatic plant will perform the photosynthesis process.
- The statement is wrong / Because most types of bacteria are heterotrophic organisms, as they don't contain the bacteriochlorophyll that enables them to perform the photosynthesis process
- (a) As the production of (¹⁶O₂) increases through the light periods, due to the occurrence of light reactions and the release of oxygen that results from the splitting of water (H₂¹⁶O), while the production of (¹⁶O₂) decreases in the dark periods, due to the stopping of light reactions
 - (b) As the alga uses the dissolved oxygen (¹⁸O₂) in water during the respiration process, as well as it uses carbon dioxide (C¹⁸O₂) in the dark reactions to form the carbohydrate substances, leading to a decrease in the concentration of (¹⁸O₂) during the period of experiment.

- The statement is correct / As a group of scientists used the oxygen isotope (¹⁸O) instead of (¹⁶O), in order to prove that water is the source of oxygen evolved in the photosynthesis process, as well as the scientist Calvin used the radioactive carbon isotope (¹⁴C) to reveal the nature of dark reactions and prove that the first stable compound formed in the dark reaction is the phosphoglyceraldehyde (PGAL).
- 13 The ability of sulphur bacteria to perform the photosynthesis process will decrease, as hydrogen sulphide is the source of hydrogen needed to fix CO₂ in the dark reactions to form the carbohydrate substances
- 15 The statement is wrong / As the dark reactions are called the enzymatic reactions (i.e. they need enzymes (co-factors) to occur)
- 16 (a) In grana inside the chloroplast of a green plant leaf
 - (b) In case of the absence of (D) "NADP", (B) "hydrogen" may escape or recombine with (C) "oxygen" again, therefore NADPH₂ will not be formed which is essential for the dark reactions, leading to the non-occurrence of photosynthesis process and the plant death
 - (c) The dark reactions will not occur, therefore the carbohydrates will not be formed, due to the absence of hydrogen that is carried on (E) compound "NADPH₂" that is required to fix the carbon dioxide gas
- Because when light falls on the molecules of chlorophyll, the electrons of their atoms become exerted to move from their lower energy levels to the higher energy levels, therefore the kinetic energy of light is stored as chemical potential energy in the chlorophyll, and on releasing this energy, part of it is used in the formation of ATP molecules that store chemical energy in the chemical bonds between their atoms.
- 18 The statement is correct / As the kinetic energy of light that falls on the molecules of chlorophyll is stored as chemical potential energy, on releasing it, a part of this energy is used in the combination of ADP molecule with

- a phosphate group to form ATP molecule, and this is known as the "photosynthetic phosphorylation".
- The rodine solution doesn't change, on adding it to the leaf part that presents inside the glass jar, as the concentrated potassium hydroxide solution absorbs CO₂ gas from the air that presents inside the jar, which prevents the occurrence of photosynthesis process, while the colour of todine solution changes in the leaf part that was exposed to light outside the glass jar from the brown colour to the dark blue colour, as the plant performed the photosynthesis process, and starch is formed in this part of leaf.
- The statement is wrong / As the dark reactions take place as a result of the occurrence of the light reactions, where the products of the light reactions complete their action in the dark reactions to form the carbohydrates.
- (a) The iodine solution didn't change in the case no. (1), as the two glass sheets prevent CO₂ gas from reaching the plant leaf, and therefore it couldn't perform the photosynthesis process and starch wouldn't be formed
 - (b) The iodine solution changed in the two cases no (2) and (3) in the green parts of leaf, as they could perform the photosynthesis process and form starch that interacts with rodine solution, so that its colour changed to the dark blue, while the yellow parts of the leaf in case no. (2) that are devoid of chlorophyll, didn't perform photosynthesis process, so that the rodine solution didn't change, while the presence of black barner in the leaf of case no (3) prevents the chlorophyll from being exposed to light in this part, and therefore the photosynthesis process didn't occur and the rodine solution didn't change.
 - (c) The rodine solution changed in the case no. (4), as the whole leaf was exposed to light, reading to the occurrence of photosynthesis and formation of starch that interacts with rodine solution, changing its colour to the dark blue colour.

- The efficiency of photosynthesis will docrease, where the rate of dark (enzymane) reactions will decrease, because the limiting factor here is the temperature. So the fixation of carbon dioxide will decrease, and therefore the carbohydrates formation will decrease, affecting the plant life.
- As ATP and NADPH₂ compounds are produced in light reactions of the photosynthesis process and during the dark reactions in the stroma, CO₂ gas is fixed by its combination with the hydrogen which is carried on NADPH₂ compound and by the help of stored energy in ATP molecule, So, carbohydrates will be formed.
- The statement is wrong / As the high-energy organic substances are formed during the dark reactions in stroma by the help of ATP and NADPH₂ compounds that were formed during the light reactions in grana.
- (a) The direction of the arrow towards the label no. (1) / As it represents CO₂ gas that is needed by the alga to accomplish the photosynthesis process
 - (b) The phosphoglyceraldehyde (PGAL) compound will not be formed, because of the absence of light that is needed by the algato perform the photosynthesis process.
 - (c) Because the oxygen enters in the structure of all products of photosynthesis (carbohydrates, water, oxygen gas), while the carbon enters in the structure of carbohydrates only that are under study
- The amount of PGAL compound will decrease, as its formation occurs by the reduction of CO₂ gas. So, in case of the absence of CO₂ gas, this compound will not be formed, therefore its level decreases.
- (a) In the chloroplast.
 - (b) (B) . light reactions.
 - (C) dark reactions
 - (e) (B light
 - (C) temperature.
 - (d) (A) water
 - (D) H₂
 - (F) glucosc.



- As the enzyme that catalyzes the breaking down of a complex molecule into simpler molecules (digestion process), also it may be able to reunite the two molecules again into the same complex molecule (anabolism process).
- The action of enzyme will be affected by increasing the temperature degree, as each enzyme has an optimum temperature at which it works efficiently So, if the temperature increases above or decreases below this temperature, the enzyme activity will decrease.
- Due to the secretion of mucus and the continuity of peristalsis process along the alimentary canal.
- Human will feel the sweet taste, due to the change of starch in the piece of bread into the maltose sugar by the action of amylase (piyalin) enzyme that presents in saliva
- [6] (a) Along the alimentary canal / Peristalsis.
 - (b) A series of muscular contractions and relaxations of the circular muscles of alimentary canal
 - (c) Sweeping, churning and mixing the food with the digestive juices along the alimentary cona.
- The food will pass into the trachea, and this will lead to human suffocation, as during the swallowing of food, the top of trachea and the larynx are elevated together, causing the epiglotus to close over the giotus.
- Because the salivary glands pour saliva into the mouth cavity which contains mucus that softens the food and facilitates its swallowing, as well as the Iming of ocsophagus contains glands which secrete mucus.
- The gastric medium will not be actific. So, the action of ptysfin enzyme will continue, the harmful bacteria that enter with food will not be killed, as well as the pepsinogen enzyme will not be activated. So, the protein will not be digested until it reaches the small intestme.

- (a) The structure no. (3) "stomach muscles" participate in the digestion process through a group of muscular contractions and relaxations "peristalsis" that sweeps, churns and mixes the food with the gastric juice.
 - (b) The functional sutability of the structure no. (1) "oesophagus":
 - Its lining contains glands to secrete mucus for softening the food and facilitating its passage
 - Its internal wall contains muscles that perform the peristalsis to sweep the food bolus to the stomach
- This will affect the stomach cells, then it will digest the stomach internal walls and this may cause stomach ulcer
- 12 (a) Pepsin enzyme / Stomach.
 - **(b)** At pH = 2.5
 - (e) Proteins / Small chains of polypeptides.
- Due to the presence of HCl acid which stops the action of amylase (ptyalin) enzyme, as HCl acid creates an acidic medium in the stomach (pH = 1.5:2.5), while the ptyalin enzyme works in a weak alkaline medium (pH = 7.4).
- [14] This experiment will be carried out again, where:
 - The temperature of the water bath is adjusted at 37°C.
 - Using a buffer solution (diluted HCI) with pH from 1.5 2.5
- Due to the stopping or reducing of heavy mucus secretions from the internal walls of stomach. So, these walls will be affected by the action of digestive nuces (gastric piece), and this will lead to the inflammation of the stomach and the occurrence of stomach ulcer.
- As the liver secretes the bile juice during the passage of food in the duodenum which works on changing the fais into the emulsified fats. So, it facilitates and accelerates the enzymatic action on the fats that don't dissolve in water



- Because it doesn't contain any digestive enzyme
- (18) The first solution: consists of adding the contents of the test tabes no (2) + (4) + (6) to the egg albumin
 - Explanation: as "pepsin enzyme" no. (2) acts on the hydrolysis of protein (egg albumin), i.e. it is conditioned that "water" no. (4) is required to be present and it occurs in an acidic medium. i.e. in the presence of "HCI" no. (6) (pH = 1.5 2.5)
 - The second solution: consists of adding the contents of test tubes no. (3) + (4) + (5) to the egg albumin
 - Explanation: as "trypsin enzyme" no. (3) acts on the hydrolysis of protein (egg albumin), i.e. in the presence of "water" no. (4) and it occurs in an alkaline medium, i.e. in the presence of "sodium bicarbonate" no. (5) (pH = 8).
- Because in the small intestine, sodium bicarbonate is secreted which changes the pH of medium into alkaline (pH = 8). So, the action of pepsin enzyme stops, as it works in an acidic medium (pH = 1.5: 2.5), as in the stomach.
- (a) The mixture shape in the test tube no. (1) is changed faster than that in the test tube no. (2), because of adding the bile juice that converts the fats (oil) into emulsified fats (i.e. dividing the large masses of fats into small fat globules) which facilitate and accelerate the action of lipase enzyme on fats to convert them into fatty acids and glycerol.
 - (b) Test tabe no. (1) / Because of the conversion of oil (fats) into fatty acids and glycerol by the action of bile june and lipase enzyme.
- Because it works on converting the trypsinogen enzyme (mactive form) into the trypsin enzyme (active form) which breaks down the proteins muo polypeptides.
- (a) They will not be digested, due to the absence of enterokinase enzyme (that is secreted from the internal wall of small intestine) from

- the pancreatic juice, where it activates
 the mactive trypsinogen enzyme and converts
 it into active trypsin enzyme to digest
 the proteins
- (b) They will be digested, but by a lower rate than normal, due to the absence of bile juice that is secreted by the liver and acts on the conversion of fats into the emulsified fats which facilitates and accelerates the action of tipase enzyme
- (c) It will be digested, due to the presence of pancreatic amylase enzyme that catalyzes the hydrolysis of starch into disacchande (malrose).
- The statement is wrong / As the fast food meals contain a large amount of fats and this stimulates the activity of bile juice to convert them into emulsified fats which facilitates and accelerates the action of lipase enzyme on the fats and converts them into fatty acids and glycerol.
- As the trypsin enzyme has a lumited effect on the digestion of protein substances, where it breaks down the proteins into polypeptides, and this is due to its mability to break the peptide bonds that present between the amino acids.

🎎 (a) The role of pB in :

- Mouth (weak alkaline medium pH = 7.4) is the sumulation of amylase "ptyalin" enzyme to hydrolyze the starch into disaccharide which is maltose
- Stomach (acidic medium pH = 1.5, 2.5) is the activation of pepsingoen enzyme (mactive form) into pepsin enzyme (active form) that digests the proteins into short chams of the polypeptides.
- Doodenum (alkaline medium pH = 8) is the stimulation of the activity of pancreatic juice that contains pancreatic amylase enzyme, trypsinogen enzyme and lipase enzyme.
- (b) Protein, it is digested in stomach at (pH = 1.5 * 2.5) and in the duodenum at (pH = 8)

- 26 (a) 1. (6) Stomach / (7) Pancrease.
 - 2. (3) Liver
 - 3. (2) Salivary glands / (7) Pancrease.
 - 4. (1) Mouth / (5) Duodenum / (8) Small intestine
 - (b) Answer by yourself
- - (B) --- Sucrase enzyme.
 - (C) ---- Glucose molecule
 - (b) The pH value, as sucrase enzyme works in an alkaline medium (pH = 8)
- (a) (X) --- Maltase enzyme.
 - (A) Multose sugar.
 - (b) Enzyme (X) "maltase" is secreted from special cells in the wall of small intestine / The molecule (A) "maltose sugar" is formed in:
 - Mouth as a result of the hydrolysis of starch by the amylase (ptyalin) enzyme.
 - Duodenum: as a result of the hydrolysis of starch and glycogen by the pancreatic amylase enzyme.
- (a) (A): starch.
- (B): malrose.
- (C) : fructose.
- (D) : lactose
- (E) : amylase enzyme
- (F) maltase enzyme
- (G) sucrase enzyme
- (H) lactase enzyme.
- (b) Glucose will not be formed / Because amylase enzyme catalyzes the hydrolysis of starch into maltose sugar, where the maltose will be digested into a simpler form that is glucose by the action of maltase enzyme.
- (c) (E), salivary glands and pancreas.
 - (F), (G) and (H): special cells in the wall of small intestine
- (1) Lipids (Fats).
- (2) Liver.
- (3) Proteins.
- (4) Pepsin
- (5) Starch.
- (6) Amylase (Ptylain).
- (7) Maltose sugar
- (a) Enterokinase enzyme.
 - (b) Pancreas
 - (c) Hydrochlone seid (HCl).
 - (d) Ptyalin (Amylase) enzyme

- As the intestinal juice that is secreted from special cells in the wall of small intestine contains a group of digestive enzymes for disacchandes that are resulted from the digestion of carbohydrates to convert them into monosacchandes that are absorbed by the villi to pass through the blood route.
- 33 The statement is correct / As eating of carbohydrates simulates the activity of digestive enzymes of carbohydrates, such as the amylase (piyalin) and pancreatic amylase enzymes, and also the digestive enzymes of disaccharides, while eating of proteins stimulates the activity of pepsin and trypsin enzymes, as well as the peptidases enzymes, but eating of fats stimulates the activity of bile juice and lipase enzyme.
- To absorb some of the finely emulsified fats that are not hydrolyzed by the enzymes through the engulfment process.
- (a) The blood capillaries transport amino acids.
 - (b) Structure no. (5) "ven" / Because it carries the blood from blood capillaries carrying glucose to the liver, then from it to the inferior vena cava and finally to the heart.
 - (e) Structure no. (1) "lymphatic vessel".
 - (d) The absorption of digested food, in addition to the engulfment of the fat globules that are not hydrolyzed by the enzymes through the engulfment process.

(e)

P.O.C.	Structure no (1) "Lymphatic vessel"	Structure no. (5)
Absorbed substances that pass through it:	Glyceror fany acids and far soluble vitamins which are A. D. E and K. vitamins.	Water mineral saits monositerbandes, animo acids and water solubie vitamins
Path of the absorbed substances:	Lacteal vessels inside the villi Lymphauc system Superior vena cava Heart	Blood capillanes in the valu Hepatic portal vein Laver Hepatic vein Infenor vena cava Heart

- (a) (1) Bile juice.
- (2) Émulsified fazs.
- (3) Lipase enzyme. (4) Glycerol
- (5) Villi.
- (6) Lacteal vessel
- (b) Answer by yourself.
- As the absorption process of digestion products consumes energy to force these products to diffuse against the concentration gradient through the blood and lymph.
- The statement is correct / As the inferior vena cava carries water, mineral salts. monosaccharides, amino acids and water soluble Vitamine.
- (a) (3) Maltose.
 - (4) Mahase enzyme.
 - (5) Blood vessel (vein),
 - (b) By diffusion and active transport.
 - (c) Villi of the small intestine.
- The statement is wrong / As the epithelial layer cells of villi participate in the absorption process and not the digestion process, where they don't secrete any digestive enzymes, but they absorb the fat globules that are not hydrolyzed by enzymes through the engulfment process.
- Because these vitamins (A. D. E and K) are soluble in the fatty acids, while vitamin (B) is soluble in water
- a) If the meat piece (protein) is:
 - · Deviod of fats:
 - The meat protein will be digested into polypeptide chains by the pepsin enzyme that is secreted from the stomach and by the trypsin enzyme that is secreted from the pancreas in the duodenum. The peptide bonds in the polypeptide chains will be broken producing different amino acids by the peptidases enzymes that are secreted from the special cells in the wall of small mitestine
 - Containing fats:
 - The fats will change into emulsified fats by the bile juice that is secreted from the liver and poured in the duodenum.

- The emulsified fats will change into fatty acids and glycerol by the lipase enzyme that is secreted from the pancreas in the duodenum, besides the digestion of proteins as mentioned before.
- (b) Answer by yourself.

Food substance	First place of digestion	Juice which digests it
Bean :	Stomach	Gastric juice
Oil:	Duodenum	Bile juice
Bread :	Mouth	Saliva

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Food substance	The final form of digestion
Веал :	Ammo acida
Oil:	Fatty acids + Glycerol
Bread:	Monosaccharides (Glucose)

- (c) The glucose sugar transfers from the blood capillaries inside the villus to the hepatic portal vein, then to the liver and from it to the hepatic vein to pour its contents into the inferior vena cava, then to the heart
- The statement is wrong / As some of the fatty acids and glycerol recombine again to form fats. and these fats pass to the facteal vessels inside the villi, then to the lymphatic system which carries them slowly and pour them into the superior vena cava, then to the heart,
- As the stomach digests the protein substances only that are digested also in the duodenum by using trypsin, while inside the small intestine the digestion of all food substances in the duodenum is completed, then the absorption of digested food in the ileum (of villi) and transporting it to the blood or lymph to be distributed to all the body cells,
- The animal will die, as its body will not make benefit from the digested food substances, due to its inability to absorb them and transfer them to the blood.

- The statement is wrong / As the absorption process takes place in other parts of the alimentary canal, whereas the lining of large intestine contains many convolutions which work on the absorption of water and mmeral salts from the wastes of undigested food
- The liver will not be able to convert the monosacchandes that resulted from the carbohydrates digestion into glycogen that is stored in the liver to be used by the body again after its oxidation to produce energy that is required for performing the body vital functions. leading to their stop and death of the living organism.
- 🍱 (a) (1) Mouth
- (2) Oesophagus
- (3) Stomach
- (4) Small intestine.
- (5) Large intextine
- (b) As in the part (2) "oesophagus", the action of ptyalia enzyme that is secreted from the salivary glands in the "mouth" (1) continues for the digestion of carbohydrates only, and its action stops in the "stomach" (3), while in the part (5) "large intestine", no digestion of food occurs, but the absorption of stored water and mineral salts from the wastes of undigested food is occurred in it.
- (c) Starch
- (d) As the food is not digested completely, but it results in the wastes of undigested food that pass to the large intestine, where they are expelled to the outside in the form of faeces.
- (e) 1. (4) Small intestine. 2 & 3. (5) Large intestine.
- 50 The body will lose (excrete) a high percentage of mineral salts and water with the faeces. So, they will lose their seim solid shape.
- 3 As HCl acid creates acidic medium in the stomach (pH = 1.5 : 2.5) which leads to the activation of pepsinogen enzyme and changing it into active pepsin to digest the protein.

Answers of Model Exam on Chapter



- (d) heterotrophic and doesn't contain chlorophyll (A) or (B)
- (X) is the pepsin enzyme and (Y) is polypepude
- (b) active transport
- 4 (1) & (3).
- (2) only
- 6 © (3) only.
- 2 ® oxygen.
- (c) distance between the light source and the plant.
- d D and E
- (6) 0/17/6
- (I) (d) PGAL containing ()18
- Peptidase.
- (C) Active transport process decreases.
- (d) CO., reduction.
- 15 (c)
- 16 @ Desert plants and salty water environment plants
- **Ⅲ** ⓒ Glucose
- (d) Peanuts and sesame.
- (a) Increases / Increases
- (d) H₂O-NADPH₂-Dark reactions,
- (d) Defectency in the amount of glucose formed from photosynthesis.
- Since the purple sulphur bacteria use H₂S instead of H₂O to produce glucose, they produce S precipitate instead of O2 gas, also they synthesize bacteriochlorophyll which is simpler in structure than normal chlorophyll.
- The rate of photosynthesis process in palisade tissue decreases and it will acquire lighter green colour as the colour of spongy tissue
- In order to receive the greatest light intenisty to perform photosynthesis process and obtain its



- The statement is wrong / Because enterokinase is a co-enzyme that activates trypsinogen (inactive form) into trypsin (active form).
- (a) The cells of structure (X) "upper epidermis" parenchyma cells are barrel-shaped to converge (collect) sunlight to inside the leaf to perform photosynthesis.
 - (b) Answer by vourself
- (a) The functional suitability of structure no.(1) "Epithelial layer" is .
 - It encloses lymphatic vessel that is surrounded by network of venous and arterial blood capillanes. So, the products of digestion can be absorbed by transfering them to the blood route by the help of blood capillaries network or to the lymphatic route through the lymphatic vessel, also the epithetial cells can absorb the fat globules that aren't hydrolyzed by enzymes directly by engulfment.
 - It contains micro-vill they are very thay projections from epithelial layer of the villus they increase the surface area of absorption
 - (b) The absorbed substances through the structure no. (2) "lacteal vessel" are fatty acids, glycerol, vitamus (A, D, E and K) and some emulsified fats

Answers of Chapter Two

Lesson

First Answers of Multiple Choice Questions

- 🚺 ⓒ Spirogyra Bean Hawk,
- 1 transfers gases to it from the surrounding medium by diffusion.
- The innermost row of cells in cortex.
- (d) Xylem.
- (E) Xylem transports water and salts, and phioem transports the ready made sap.
- 6 @ Barvel-shaped cells that have a storage function.
- 🕜 © Cambium.
- 8 (1).
- (a) companion cells.
- 10 (1) (1) (1) the tissue changes into a xylem tissue.
 - (2) (b) cytoplasm.
- Xylem tissue.
- (a) It contains vascular bundles that scattered through the pith tissue.
- 13 (1) (a) vessels and tracheids
 - (2) (b) transporting water.
 - (3) (d) the stages of their formation.
- [14 (1) (d) Each of the xylem and phloem will not be
 - (2) © its cells don't contain a nucleus or cytoplasm.
 - (3) (b) Transporting the high-energy food only
- FO
- (C) cambium tissue
- © Sucrose / Downward and upward.
- C Osmosis
- 20 a The amount of water lost is greater than the amount of water uptake.
- [2] (b) Inorganic ions.
- © 35 / 52 275 / 18
- It is a permeable substance to water and solutes
- C Pectin and lignin.
- Active transport process of food in the sieve tubes.
- © transparation pull
- adhesion force among water molecules
- **见**⑥(C).

- (a) (b) the presence of cohesion force.
- 30 (b) The absorbed heat from the Sun.
- 31 a more than
- 12 (b) Fatty acids.
- Amino acids and sugar will not be transported to the roots.
- 35 © Increasing of both the temperature and the concentration of oxygen
- 36 (1) (b) sieve tube.
 - (2) © xylem vessel
 - (3) © both of (X) and (Y) are osmosis.

Second Answers of Miscellaneous Questions

1 The statement is wrong / Because the Spirogyra alga belongs to the aquatic algae that don't need the presence of specialized transport tissues, where the raw materials transfer with the products of photosynthesis process from one cell to another by diffusion and active transport.

	The anomalous word	What links the rest
(1)	Cambium	Plant tirsues that consist of parenchyma cells.
(2)	Phioem parenchyma	Non-living plant cells.

3 As the vascular bundle in the stem consists of phloem, cambium and xylem, while it consists of xylem vessels and phloem only in the leaf

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The structure no.	The importance
(2) "Cytoplasmic threads":	Carry the high-energy organic food substances from a sieve tube to another through the pores of sieve plares, till reaching all the plant parts.
(4) "Companion cell" :	Regulate the vital processes of steve tubes and supply them with energy in the form of ATP molecules, as it contains a large number of ribosomes and mitochondina

(b) The transport of energy carrier compounds (ATP molecules) that are formed abundantly in the part no. (4) "companion cell" to the part no. (1) "sieve tubes", where plasmodesmata connects the cytoplasm of sieve tube with the cytoplasm of companion cell.



- (c) The structure no. (4) "companion cell" will die, therefore it will not be able to regulate the vital processes of sieve tubes structure no. (1), leading to the stop of ready made sap transportation to all the plant parts, and therefore the plant die.
- By making a transverse section in the stem of each of plant (A) and (B), then examining the structure of vascular bundles in the stem by using a light microscope, we will find that the older plant has vascular bundles containing secondary phloem externally and secondary xylem internally in a greater amount than the younger plant, so that the surface area of the section in the older plant is larger than that of the younger plant
- The thickness of plant's stem will not increase, due to the absence of menstematic cells (cambium) that divide to give rise to a secondary phloem externally and a secondary xylem internally.
- As the phloem of leaves is connected with the phloem of stem and roots, so that a connected network of conducting vessels is formed in all the plant parts, therefore the roots obtain their food after the performance of photosynthesis process and formation of high-energy organic compounds inside the plant leaves.
- As xylem tissue contains xylem parenchyma which are represented by rows of living parenchyma cells avesent between the xylem vessels.
- The lining of xylem vessel contains strands of lignis in different shapes, such as spiral and annular, to support the xylem vessel and prevent the inward collapse of its wall
- (a) Because the lining of structure no. (*, "xylem vessels" contains strands of lignin that work on the non-collapsing of its wall inward.
 - (b) The structure no. (1) "xylem vessels" / Because the structure no. (1) consists of a series of elongated cylindrical cells that are joined end to end, therefore it is opened at the two ends, while the structure no. (2) "tracheids" each of them consists of one cell with tapered ends. So, the structure no. (1) has a greater role than the structure no. (2) in transpoxing water and salts made the plant.

- (c) The structure no. (I) is characterized by several characters, such as :
 - The walls of xylem vessels consist of cellulose and lighth that have a colloidal nature which is able to imbibe water, explaining the imbibition theory
 - The diameter of xylem vessels ranges between 0.2 0.5 mm, which explains the capillarity theory.
 - 3 The adhesion force between the water molecules and walls of xylem vessels that keeps the water columns held continuously against gravity, which explains one principle of the cohesion - adhesion transpiration pull theory.
- (d) Water will not pass from inside the xylem vessel to its outside
- The walls of xylem vessels contain many pits to allow the passage of water from inside the vessel to its outside
- 12 (1) The functional suitability of xylem :
 - Vessels
 - Consist of a series of elongated cylindrical cells that are joined end to end and have opened ends, in order to allow the movement of water and saits from the root to the leaves for performing the photosynthesis process
 - Their walls consist of cellulose and lightn with a colloidal nature that has the ability to imbibe water, as well as lightn is impermeable to water and solutes.
 - Their walls contain many pits that allow the passage of water from inside the vessel to its outside.
 - -Their lining contains strands of lignin in different shapes, such as spiral and annular, to support the vessel and prevents the inward collapse of its wall working on the plant support.
 - * Tracheids

They are similar to the vessels, but each one of them consists of one cell with tapered end, and it is pitted more than the vessel, as well as the passage of water and saits through them is less than their passage in the xylem vessels.

(2) The functional suitability of phloem:

- Sieve nibes
- Elongated cells contain cytoplasmic threads, acting on transporting the ready made food substances (sap) from the leaf to all the plant parts.
- They are separated from each other by perforated cross-walls "sieve plates" to allow the passage of cytoplasmic threads through them
- · Companion cells :

Living cells, where each of them accompanies a sieve tube, they contain a large number of ribosomes and mitochondria to be able to organize the vital functions of sieve tubes and supply them with energy needed for the transport process in the form of ATP molecules.

- The statement is wroag / As transport process takes place through a group of tissues containing non-living cells, whereas xylem, which consists of non-living cells (vessels and tracheds) and living cells (xylem parenchyma), as well as the phloem consists of non-living cells (sieve tubes) and living cells (companion cells and parenchyma cells).
- [6] Answer by yourself.
- (a) The function of structure no. (3)
 "collenchyma cells":
 - Have a supporting function
 - Perform photosynthesis process, if they contain chloroplasts.
 - The function of structure no. (5) *starch sheath* : storage of starch granules.
 - (b) The non-living structures that are penetrated by living cells are:
 - 1. Xylem tissue that consists of .
 - · Non-fiving cells
 - Structure no. (9) "secondary xylem"
 - Structure no. (12) "primary xylem".
 - Living cells

Structure no. (10) "xylem parenchyma".

2 Phloem ussue. The structure no. (7) and consists of sieve tubes "non-living cells" and companion cells "tiving cells".

- (c) Parenchymatous tissue is present in :
 - Epidermis layer "structure no. (2)".
 - Parenchyma cells in the cortex layer "structure no. (4)"
 - · Pericycle "structure no. (6)"
 - Phloem parenchyma "structure no. (7)".
 - * Xylem parenchyma "structure no. (10)",
 - Medullary rays "structure no. (11)"
 - Pith *structure no. (13)*
- 16 As cotton plant's stem contains
 - Collenchyma cells in the cortex layer that have a supporting function.
 - Pericycle tissue in the vascular cylinder region which consists of parenchyma cells alternate with groups of fibrous cells, acting on strengthening the stem and making it erect
 - Xylem tissue, where the lining of its vessels and tracherdes contains lignin which supports the stem.
- 17 (a) The curve (AB) illustrates the inversely relationship between the diameter of xylem vessels and the height of water inside them, as when the diameter of xylem vessel decreases, the height of water inside it increases by the capillarity phenomenon.
 - (b) Because the maximum height of water in the finest tube never exceeds 150 cm (1.5 m).
 - (c) Water will not rise in the xylem vessel by capillarity phenomenon.
- Because the hydrogen bonds work on the cohesion of water molecules with each other strongly inside the xylem vessels and trachends, which keeps the presence of connected (continuous) water column inside the xylem vessels.
- Because the walls of xylem vessels consist of cellulose and lignin with a colloidal nature that has the ability to imbibe water, helping in the adhesion force among water molecules and walls of xylem vessels, therefore it works on the presence of water columns held continuously.
- The statement is wrong / As water transfers from the root to the leaves, according to the following arrangement; root hair - cortex xylcm - mesophyll tissue - stomata.
- Answer by yourself.



- (a) Cohesion force between the water molecules each other inside the xylem vessels and tracheids
 - Adhesion force between water molecules and walls of xylem vessels
 - Transpiration pull force that results from the continuous transpiration in the leaves.
 - (b) Answer by yourself
 - (e) It is noticed the exit of water from the stump (exudation phenomenon), and this occurs due to the action of a pressure or force from the root "root pressure".
- (a) Air chambers of stomata in the leaf
 - (b) Answer by yourself
 - (c) The high-energy organic compounds (carbohydrates, proteins and fats)
- Transpiration process / As plant physiologists had proved that the cohesion, adhesion and the pulling force that results from transpiration are the main forces that work on pulling water in the stem for high and long distances reaching about 100 m, while the maximum level of water in the finest xylem tube doesn't exceed 150 cm under the effect of capillarity phenomenon.
- The statement is correct / As the two scientists. Thain and Canny could see long cytoplasmic threads carrying organic substances inside the sieve tube and extending from a tube to another through the pores of sieve plate, and this is called by "cytoplasmic streaming".
- The cytoplasmic streaming movement through the sieve tubes needs energy, where the transport process in phloem is active process which needs energy carrier compounds (ATP molecules) that are formed abundantly in the companion cells and transfer from them by the plasmodesmata that coanects the cytoplasm of companion cell with the cytoplasm of sieve tube.
- 27 As the excessive irrigation leads to the replacement of air that presents among the soil particles with water, and therefore oxygen is vanished or decreased in the plant cells, which slows down the movement of cytoplasm and its streaming in the seve tubes, delaying the active transport process in the phloem.

- 28 Answer by yourself.
- As the transport process of water and salts through the xylem vessels is affected by :
 - The root pressure which affected rapidly by the external factors
 - The pulling force that arises from transpiration and affected by external factors, such as temperature, humidity and light.

As well as the transport process of organic substances in the phloem is affected by external factors, such as temperature and oxygen.

Because the decreasing of temperature or shortage of oxygen in the cells slows down the movement of cytopiasm and its streaming in the sieve tubes

Lesson 📜

- Answers of Multiple Choice Questions
- 1 (a) Tricuspid valve.
- 2 © Right strium / Left ventricle.
- 3 (B) (B).
- They present at the connection of the heart with superior and inferior venae cavae.
- 5 d) it stimulates the muscles of two ventricles to contract
- 7 6 Aorta Pulmonary vem Renal artery.
- 🔝 a Pulmonary vem.
- (1) Renal vein
- Blood vessels contain valves.
- 11 d) It carries deoxygenated blood.
- 12 ® foot to heart.
- **1 (1)** & (3)
- 14(1) (d) It carries oxygenated blood.
 - (2) (b) It carnes deoxygenated blood.
- (S) Vein Blood capillary Artery.
- 16 d Their wall contains tiny pores.
- 17 b glocose, oxygen and carbon dioxide
- C Amino acids. 19 @ fibrin.
- (a) Glucose, hormones and urea.

- 21 @ (Z).
- ₽ € О,
- (d) Two hungs.
- **1** (b) Охудел.
- 25 © white blood corposcles
- 26 a
- 27 6 Q/P/S/R
- 6 occurrence of congulation, on exposure to blood bleeding
- 29 © Plasma / Red and white blood corpuscles and blood platelets.
- (a) red blood corpuscles.
- Bone marrow.
- (b) teared blood vessels and cells.
- (C) vitamin K
- obstruct the movement of blood in normal
- Breaking down of blood platelets inside
 the blood vessel
- Prothrombin and heparin.
- 38 (1) (b) Eggs.
- (2) (a) fruits.
- (2) & (3).
- b arteries of right arm
- (D).
- (C) The contraction of left ventricle.
- h 📆

Second Answers of Miscellaneous Questions

- (X) / As the circulatory system in animal (X) is from the closed type, where the heart and blood vessels are connected together in a closed circuit, therefore the blood doesn't come out of them to the body cavity.
- Mesentery: it is a membrane that joins the folds of small intestine of digestive system.
 - Pericardinm membrane: it is a membrane that surrounds the heart and works on its protection and facilitating its movement.
- The statement is correct / As the heart valves allow the blood to pass in one direction only.
- Blood will return back from the two ventricles to the two atria, as the valves work on preventing the backflow of blood to the two atria, so that occurrence of a disturbance in the blood circulation

5

The anomalous word	What links the rest
Grief state	States at which the rate of heartbeats increases.

- The heartbeats will stop, as the sino-atrial node releases a spontaneous contraction impulse, therefore it stimulates the muscles of two atria to contract, and when the nervous electric impulse reaches the atrio-ventricular node, it moves from it rapidly through His fibers, then spreads from the mier-ventricular septum to the wall of two ventricles, stimulating their muscles to contract. Therefore, its absence prevents the occurrence of this.
- 7 (a) (A) : nortic valve "semi-lunar valve".
 - (B) left bicuspid "Mitral" valve
 - (C): right tricuspid valve.
 - (D): pulmonary valve "sems-lunar valve".
 - (b) (1): oxygenated blood / under low pressure.
 - (2) oxygenated blood / under high pressure.
 - (3): deoxygenated blood / under high pressure.
 - (4): deoxygenated blood / under low pressure.

(c)

The structure no. (6) "right ventricle"	The structure no. (7) "left ventricle"
• It carries deoxygenated blood. • Its wall is less thick. • It is separated from the right atrium by a tricuspid valve.	It carries oxygenated blood Its wall is more thick. It is separated from the left atrium by a bicuspid valve.

- (d) By changing the physical or psychological states, where the structure no. (5) "sino-atrial node" is connected with a nerve "sympathetic" that increases the rate of heartbears gradually after waking up, in states of joy and when performing a vigorous physical effort.
- The heartheats can be differentiated into two sounds, as follows.
 - Long and low-patched (Lubb) sound, as a result of the closure of two valves between the airia and ventricles, during the ventricular contraction

- Short and high-pitched (Dupp) sound, as a result of the closure of nortic and pulmonary valves, during the ventricular relaxation
- As the contraction impulse (stimulus) reaches from the sine-orial node to the muscles of two atria directly, therefore they contract first, while the contraction impulse reaches the muscles of two ventricles from the atrio-ventricular node through His fibers, then spreads from the inter-ventricular septum to the wall of both ventricles, therefore the contraction of two ventricles comes after that of the two atria.
- 10 To protect them from any damage. As even a minor damage in the arteries may result in the loss of a great amount of blood, due to the high blood pressure in the arteries
- To afford the blood pressure, whereas the artery carries blood from the heart to all the body parts during the contraction of two ventricles, while the vein carries blood from the different body co.ls to the heart
- (a) Vein
 - The reasons :
 - The blood is directed upward (in the direction of the hears)
 - 2. The presence of valves in it.
 - (b) When the two muscles contract, the blood is pushed upward and the valves prevent its backflow in the opposite direction.
 - (e) The contraction of two muscles leads to an increase in the rate of heartbeats, where the change of physical state "performing effort" is followed by an increase in the number of beartbeats by the action of a nerve "sympathetic" that is connected with the sinoatrial node which is considered the pacemaker of the heart.
 - (d) The presence of valves inside the vein
 - The muscles that surround the vena
- Because of the increased blood pressure in it more than that in the vein, therefore the bleeding from artery results in a great loss in blood volume

The anomalous word	What links the rest
Pulmonary artery.	Blood vessels contain oxygenated blood.

- 15(a) (X) : artery. (Y) : vein.
 - (b) The inner layer of vessel (X).
 - Their presence is rare in the vessel (Y).
- Due to the presence of valves in some veins that allow the passage of blood in the direction of the heart and prevent its backflow, such as the veins that present in limbs which are near to the skin surface.

17

Pulmonary vein	Pulmonary artery
• It carries oxygenated	• It cames
blood.	deoxygenated blood.
• Inside it the	- Inside it the
oxygenated blood	deoxygenated blood
moves from the two	moves from the right
lungs to the left atrium	ventricle of the heart
of the heart.	to the two lungs.
. Its wall is less thick.	• Its wall is more thick.
Not pulsated.	Pulsated

- The blood will return back in the veins and will not be directed towards the heart, because the valves work always on the passage of blood in one direction, so that a disturbance in the blood circulation will occur
- (a) The walls of structure no. (2) "blood capillaries" are thin and the presence of tiny pores among its cells help in the rapid exchange of substances between the blood and ussues' cells
 - The structure no. (2) "blood capillaries" spread in the spaces between the cells of all the body tissues to supply them with their requirements of food and oxygen.
 - (b) It spreads in the spaces among cells of all the body tissues.
 - (c) 1. The structure no. (1) "artery".

 2 The structure no. (3) "vein"
 - (d) 10 mm Hg

- The statement is correct / whereas some (veins) contain valves that allow the passage of blood in the direction of heart and prevent its backflow, such as the veins that present in limbs and are near to the skin surface
- [2] Each of them has thin wall.
- The statement is correct / As water represents 90% of the volume of blood plasma that represents 54% of the blood volume
- The individual will be infected with anemia which is accompanied by a decrease in the haemoglobin efficiency in transporting oxygen from the two lungs to all the body parts, and transporting carbon dioxide from all the body parts to the two lungs.

tall?	
The anomaious word	What links the rest
Carbo-aminohaemoglobin.	Haemoglobin combines with oxygen, forming oxyhaemoglobin

- The percentage of hasmoglobin in red blood corpuscles will decrease below the normal percentage (level), whereas hasmoglobin consists of protein and iron, leading to a person infected with anemia disease
- The statement is correct / As the higher the height above sea level, the lower percentage of oxygen in air, leading to an increase in the number of red blood corpuscles to transport the greatest amount of oxygen required for the body.
- As the prothrombin (protein secreted by the liver with the help of vitamin (K) and poured in the blood) has a role in the formation of blood clot, where it is converted into thrombin in the presence of thromboplastin, calcium ions and clotting factors, while fibringen (soluble protein in the blood plasma) is converted into fibrin in the presence of thrombin engyme
- As liver secretes:
 - Prothrombin protein by the help of vitamin (K) and pours it in the blood, then it is converted into thrombin in the presence of

- thromboplastin, calcium sons and clotting factors, then it sumulates the conversion of fibranogen into fibran, therefore the blood clot is formed.
- Heparin substance that prevents the conversion of prothrombin into thrombin, therefore the blood clot will not be formed inside the blood vessels in the normal state
- The liver secretes prothrombin protein by the help of vitamin (K) and pours it in the blood to be converted into thrombin that has an important role in the formation of blood clot, when the blood vessel is cut or teared.
- 30 Oxygen gas (O.).
- 31 Answer by yourself
- As fibrin protein is insoluble to blood plasma, it precipitates in the form of a network of microscopic interlacing fibers in which the blood cells are aggregated forming a clot which blocks the cut in the damaged blood vessel to stop the bleeding.
- The liver secretes the prothrombin protein by the help of vitamin (K) and pours it in the blood, then it is converted into thrombin in the presence of thromboplastin, calcium ions and clotting factors, then it stimulates the conversion process of fibrinogen into fibrin, therefore the blood clot is formed.
- (a) Answer by yourself
 - (b) 1 Protecting blood from bleeding that may lead to the death.
 - 2 Protecting the body from the invasion of microbes and pathogens in the site of injury or the cut blood vessel
 - (c) Thrombin enzyme / It stimulates the conversion process of fibrinogen into fibrin, forming the clot that blocks the opening of cut blood vessel to stop the bleeding.
- The statement is wrong / In the normal case of blood, it contains a varied group of proteins that are soluble in the plasma, such as albumin, globulin and fibrinogen, while in case of occurrence of blood clot, the blood contains insoluble proteins, such as fibrin.



- 36 As the secretion of prothrombin protein that is secreted by the liver by the help of vitamin (K) decreases, which changes into thrombin that helps in converting the fibringen into fibrin filaments that cause the blood clotting, when the blood vessels are cut or teared
- As the deposition of some types of lipids (that result from the digestion of fatty food) inside the blood vessels, leads to the formation of rough surface which obstructs the flow of blood inside the blood vessels in a normal manner, therefore it stimulates the formation of blood clot inside the blood vessel.

The anomalous word	What links the rest
	Proteins present in the blood plasma and help in the formation of blood clos.

- The figure no. (2) represents the systolic blood pressure, and the figure no. (1) represents the diastolic blood pressure / Because the level of mercury column is higher in the figure no. (2) which represents the maximum blood pressure "systolic"
- The statement is wrong / The maximum blood pressure is in the arteries that present close to the heart, where the ventrules contraction (heart beating) leads to the increase of blood pressure.
- (a) The figure (X) represents the maximum value of blood pressure.
 - The figure (Y) represents the minimum value of blood pressure
 - (b) The sound in (X) is long and low-pitched (Lubb), while the sound in (Y) is short and high-pitched (Dupp).
- (a) At the point (X): the blood pressure increases inside an artery when the two veatricles contract within a hearthear.
 - At the point (Y) the blood pressure decreases inside an artery when the two ventricles relax within a heartbeat,
 - (b) The blood pressure decreases gradually, as we go far from the arteries that are near to the heart, till reaching the minimum value in the vensiles and blood capillanes (10 mm Hg)

- (c) To allow the exchange of gases, digested food substances and excretory substances easily between blood that present in the blood capillaries and body cells.
- (d) As the walls of blood capillaries are very thin and consist of one cellular layer that consists of one row of thin epithelial cells, so that the blood passes very slowly through them, in order to the blood capillaries not to be ruptured and to prevent the occurrence of bleeding
- As the occurrence of bleeding leads to the loss of large amount of blood, leading to a decrease in the blood level in the body, therefore the blood pressure decreases

Lesson 📋

Answers of Multiple Choice Questions

- 1 d two arria right ventricle left ventricle.
- Left atrium.
- 3 6 Left ventricle Aorta Renal artery.
- (C) left ventricle.
- C vens cava.
- (a) Aortic valve.
- 1 (D) Closed / Opened
- (8) (b) pulmonary and sortic valves,
- (9) (d) The closure of pulmonary valve.
- 10 Bicusped and acrtic valves.
- (1) (1) Oxygentated / Oxygenated
- 12 @ Lungs.
- 13 @ I
- The two ventricles are filled with blood at the same time.
- 15 (b) Pulmonury artery.
- (C) storta artery.
- 17 (b) (L) --- (X) --- (Z).
- The opening of pulmonary valve and the closure of tricuspid valve.
- 19 (1) & (2).
- 20 3
- (a) The closure of mutral valve and opening of aortic valve.
- Foot Heart Two lungs
 Heart Arm.
- 23 ⓑ X -- 2 -- Y -- L

- $(1) © (L) \longrightarrow (Z) \longrightarrow (Y) \longrightarrow (X).$ (2) @ (X).
- (1) © Transporting the deoxygenated blood from the heart to the two lungs.
 - (2) (d) Inferior vena cava.
- (d) kidneys.
- 1 (B).
- Small antestine.
- 10 (1) (a) Glucose.
 - (2) (arbo-aminohaemoglobin.
 - (3) © upper part of inferior vens cava.
- **10** ©
- **31** (1) ⓒ (6) → (7) → (8) → (5)
 - (2) (b) Liver.
- (1) The two statements are correct.
- Bone marrow,
- 116
- 35@0,/co,

Second Answers of Miscellaneous Questions

- Because the ventricle pushes the blood to a longer distance either to all the body parts (left ventricle) or to the two lungs (right ventricle), while the atrium pushes the blood to its opposite ventricle only,
- As acres pushes the oxygenated blood from heart to all the body parts (i.e. to long distance)
 So, it needs higher blood pressure, while the pulmonary artery pushes the deoxygenated blood from heart to the two luags (i.e. to short distance), so that it needs lower blood pressure.

Bicuspêd valve	Tricuspid vatve
Lies between	* Lies between
the left atrium and	the right atrium
left ventricle.	and right ventricle.
 Allows the passage 	- Allows the passage of
of blood (oxygenated)	blood (de-oxygenated)
from the left atrium to	from the right atrium
the left ventricle in one	to the right ventracle
direction, and prevents	in one direction, and
its return to the left	prevents its return to
atrium again.	the right atrium again

- Because the left ventricle pushes the blood from the heart to all the body parts (i.e. to long distance), while the right ventricle pushes the blood from the heart to the two lungs (i.e. to short distance).
- The statement is wrong / The blood vessel that contains the highest level of glucose is the hepatic portal vein, as villi of small intestine absorb glucose and amno acids that are transfered to the blood capillaries present inside the villi, then these blood capillaries aggregate in larger and larger veins and pour their contents in the hepatic portal vein
- As the food (glucose and amino acids) that is absorbed from the small intestine pass first to the liver, in order to filter some food substances that exceed the body needs, therefore some changes occur inside the liver, where the monoschandes are converted into polysacharides stored in the form of glycogen
- 7 Blood capillaries in vill, --- Hepatic portal vein

Liver

Right atrium Inferior Hepatic of the heart vena cava vein

- (a) Some changes occur to them in the liver, where the monosaccharides, such as glucose are converted into glycogen that is stored in the liver.
 - (b) Pancreas, spleen and stomach
 - (c) The blood vessel no. (3) "Hepatic portal vein".
- Answer by yourself
- (a) Hepatic portal circulation.
 - Mososachandes (as glucose) and amino acids
 - (b) Lymphatic route.
 - Glycerol and fatty acids.
 - (c) The blood vessel no. (1) "Hepatic portal vem".
 - (d) The blood vessel no. (2) "Hepane vein" pours in the inferior vena cava.
 - The "lymphatic vessel" no. (4) pours in the superior vena cava.

11 (a) 1, (4).

2. (1) & (2).

3 (4).

(b) & (e): (X)

- (d) * The type of blood in the blood vessel no. (2) "Aorta" : exygenated blood.
 - The type of blood in the blood vessel no. (7) "Pulmonary artery": decaygenated
- The body will not be able to destroy the microbes that attack it, and couldn't filter the lymph from the microbes before its transfer into the bloodstream that passed in the superior vena cava, so that it causes the spreading of microbes inside the body and exposing it to the infectious thiseases.
- Spleen has a great importance in the circulatory system, as inside it new white blood corpuscles are formed continously and the red blood corpuscles are destroyed after ending their age, as well as it has a great importance in the lymphatic system, where it is considered one of the most important lymphatic organs in the body that are responsible for the production of antibodies to destroy the microbes and acquiring the body with the immunity
- (a) The defensive ability of the body will decrease, where the structure up. (1) "spleen" is considered from the most important lymphatic organs in the body that are responsible for acquiring the body with immunity
 - (b) The production of white blood corpuscles from the structure no. (2) "lymphatic nodes" will increase, when the body is exposed to an infection, to destroy the microbe that causes the disease.
 - (c) The fluid (lymph) that presents in the structure no. (3) "lymphatic vessels" contains all the components of plasma, in addition to a large number of white blood corpuscles.

Answers of Model Exam on chapter 2

9

- 1 © The ventricles will relax.
- (a) right atrium
- 🚺 🗿 lts wall is thick.
- b) transfers gases to it from the surrounding medium by diffusion.
- 5 d) Vitamin (K).
- 3 d D
- 7 b B
- G d D
- (2) (1) a
- b (B)
- E C (C)
- Hepatic portal vein
- R&Q
- Acreation and storage
- ₩ d 130
- 1 b Adhesion force
- Plasma
- T F HCO,
- 21 3 Transpiration process and transporting ready made food decreases
- Water won't be absorbed by osmosis and salts won't be absorbed by diffusion, therefore the plant will die and the root pressure becomes equal to the water column pressure
- Since the exposure to an injury may cause infection through invasion of microbes, therefore WBCs count increases
- It is considered a transport system, because the lymphane vessels carries the absorbed food substances (farry acids, glycerol and fat soluble vitarturs) and pass them to the superior vera cava then to the heart. Also, it is considered the immune system, because it produces antibodies and the lymph has a large number of WBCs, so that it plays a major role in the defensive ability.
- 25 Both of them contain parenchyma cells.

- (a) Artifical valve (precessed valve) / It allows the passage of blood in one direction only from the right atrium to the right ventricle and prevents its backflow in the opposite direction.
 - (b) (Z) Downwards to the right ventricle.(L) Upwards to the right atrium.
- (a) The components in blood vessel no. (1) :
 "artery": O2 "oxyheamoglobin".
 - The components in blood vessel no. (2)
 "vein": CO₃ "Caro-aminoheamoglobin".
 - (b) In blood vessel no. (1). From the heart to the body parts.
 - In blood vessel no. (2) * From the body parts to the heart.



Answers of Chapter Three

Lesson

Answers of Multiple Choice Questions

- (1) a energy
- (2) (a) (X)
- - transfer the energy easily to perform the function of the cell
- @ number of phosphate groups.
- d Phosphoglyceraldehyde
- fructose 1, 6-diphosphate
- b. Photosynthesis in the green plants.
- a) ATP
- 3 93 16 (2C)
- b, 6 b) 8
- a 4 13 © two molecules
- d) dark reactions in stroma
- d losing electrons from glucose. 16)9
- (1) @ CO, / H,O / ATP / O,
- (2) a coenzymes exidation
- d) four times
- 😰 © after glycolysis, before entering and during Krebs cycle.
- (b) NAD*
- **11 ⓑ** 2
- **₩** (b) 34
- © mitochondria and cytosole.
- a sequence of exidation and reduction reactions.
- a Glycolysis
- 26 a glycolysis
- a) 2
- 🛂 🤤 tematrung of energy stored in the pyruvic acid
- b 19 1
- 30 a pyruvic acid.
- c water,
- (a) zero.
- (3) is greater than that of no. (1) and (2).
- 31 (a) from alcoholic fermentation is greater than that from the acidic fermentation
- **35** (b) 15
- 36 (3) lactic sold from pyravic sold.
- 唇(6)

Answers of Miscellaneous Questions

Because the majority of living organisms' cells use the glucose molecule to produce energy more than using any other available food molecule.

d	100	
п	7 .	
ı	aller 1	

ATP - Adenosine

- triphosphate It consists of adenine base inbose sugar -
- three phosphate groups · When ATP is converted into ADP.

reseased

- ADP
- Adenosine diphosphate
- It consists of adenine base inbose sugar two phosphate groups
- When ADP 15 converted into ATP. an amount of energy is an amount of energy is stored
- 3 As the cellular respiration occurs either in the presence, absence or lack of oxygen at the body temperature (37°C), producing an energy that is stored in the form of ATP molecules, while the occurrence of burning process requires the presence of oxygen at high temperature to oxidize the organic substances, producing energy that is not stored
- Because energy is released rapidly from each ATP molecule when it loses a phosphate group to change into an ADP molecule, and this occurs when the cell needs energy
- 5 The statement is correct / As when breaking down the bond that presents between the two phosphate groups. ATP molecuse changes into ADP and an amount of energy is released
- 6 Because glycolysis stage doesn't require the presence of oxygen, so that it occurs in case of the presence or absence of oxygen to produce energy
- 7 6 molecules of ATP
- 8 The statement is correct / As proteins are digested into amino acids which are broken to form acetyl groups that combine with the coenzyme (A) to join Krebs cycle.

ı		
-	_	_
ſ		_

The anomalous word	What links the rest
Lactic acid.	Intermediate compounds in Krebs cycle.

The acetyl groups will not be transferred to the reactions of Krebs cycle, and so the reactions of aerobic respiration will stop.

- 11 The statement is wrong / As the oxidation of intermediate compounds in Krebs cycle occurs by losing electrons that are received by NAD* and FAD
- 12 (a) Starch in plant cells.
 - · Glycogen in animal cells.
 - (b) Glycolysis / In the cytosole.
 - (c) They are carried on NAD* and FAD molecules to enter in the electron transport chain, in order to release energy from them.
- 1 4 Coenzymes.
- The statement is wrong / As the number of ATP molecules that are formed in one Krebs cycle equals one ATP molecule, i.e. when Krebs cycle is repeated for 4 times, 4 molecules of ATP will be produced.
- To remove the electrons that are received by FAD and NAD* molecules, in order to transport them to the cytochromes to release the energy required for producing ATP molecules, leading to an increase of the released energy

NAD*	NADP
Coenzyme presents in the mitochondria and cytoplasm	Coenzyme presents in the chloroplasts.
• Receives the hydrogen (H ₂), forming NADH compound. NAD'+H, Reduction NADH+H*	• Receives the hydrogen (H ₂), forming NADPH ₂ compound. NADP+H, Reference NADPH,
RAD+H RECEIVES the electrons that are removed from the oxidation of carbon atoms during the group of reactions of ceilular respiration to transport them to the cytochromes for releasing the energy required to produce ATP	Carries the hydrogen required to reduce CO, for forming carbobydrates during the dark reactions in photosynthesis process

- 17 Due to the absence of cytochromes.
- 18 The case no. (2) / It represents the electron transport chain, because the cytochromes that present in the inner membrane of mitochondria carry the electrons at different energy levels
- 19 Answer by yourself
- 21) The statement is wrong / As the oxidation of 3 molecules of glucose during the electron transport chain produces 102 molecules of ATP



The anomalous word	What links the rest
ATP	Coenzymes

- 22 4 ATP molecules
- The number of reduced NAD* molecules = 10
 The number of reduced FAD molecules = 2
- As some living organisms can obtain energy from food (glucose) molecule in the absence or lack of oxygen by the help of a group of enzymes through the anaerobic respiration (fermentation), as in yeast and bacteria.
- At the point (3) / Because at the end of race, the muscular cells resort to the anaerobic respiration, where they consume all the oxygen that presents in them, therefore they tend to reduce the pyruvic acid into factic acid.
- The statement is correct / As the muscular cells resort to the anaerobic respiration, when they consume all the oxygen that presents in them, so that the anaerobic respiration occurs after the aerobic respiration.
- 27 2 molecules of lactic acid.
- 28 (a) * W maltose. X glucose.
 - Y : pyntvic acid.
- Z lactic acid
- (1) · digestion
- (2) glycolysis.
- (3) : acidic fermentation



- (b) . The number of carbon atoms decreases to the half, on the occurrence of :
 - The step no. (1): because of the digestion of maltose molecule (disaccharide) by the action of maltase enzyme and the formation of 2 molecules of glucose (monosecchande).
 - The step no. (2) because of the glycolysis of glucose molecule into 2 molecules of pyruvic neid
- (c) . The presence of maltase enzyme and ajkaline medium (pH = 8) to accomplish the step no. (1).
 - The presence of 2 molecules of ATP to accomplish the step no. (2).
 - The presence of a group of enzymes to accomplish the step no. (3) in the absence or lack of oxygen
- (d) 4 ATP molecules.
- (e) 15 molecules of ATP / As in case of the presence of oxygen, the lactic acid is oxidized into pyravic acid again, then to acetyl CoA to accomplish the stages of aerobic cellular respiration (Krebs cycle and electron transport chain) and produces energy
- 29 As the acetyl groups that resulted from the breaking down of the fatty acids and amino acids molecules can combine with the coenzyme (A) and join the Krebs cycle, then the electron transport chain without forming pyruvic acid.

The anomalous word What links the rest Muscular cells Alcoholic fermentation

- They resort to the anaerobic respiration, as the pyruvic acid that resulted from the glycolysis is reduced into factic acid "acidic fermentation". and produces 2 molecules of ATP
- (a) The graduated cylinder no. (2) / As carbon dioxide gas that resulted from the alcoholic fermentation process in yeast increases the volume of maxture
 - (b) The importance of no. (1) "acidic fermentation": used in dairy industries. such as cheese, butter and yogurt.

- The importance of no. (2) "alcoholic fermentation": used in the bread and alcohol industries
- 33 (a): (4).
- Oh : (3). (e):(1).
- (d) . (5).
- (e) (2)
- 34 As the hydrolysis of sugar molecules into glucose occurs to facilitate their use in the unaerobic respiration process.
- (a) 1. (5) "Inner membrane of mitochondria". 2. (4) "DNA"
 - (b) The reason for the presence of structure no. (1) "ribosomes" is the formation of the enzymes required for the aerobic respiration process inside the mitochondria.
 - (e) The structure no. (3) "cristae" which represent the inner membrane of mitochondria and contain sequences of coenzymer that carry the electrons at different energy levels to accomplish the last stage of aerobic respiration which is the electron transport chain.
- 36 Similarity: both of them are vital processes that occur in the cells of living organism to obtain the energy stored in food molecules. especially glocose and store it in the form of ATP molecules
 - The main conditions for the occurrence of fermentation process:
 - The absence or shortage of oxygen
 - The presence of a group of enzymes.

Lesson 🔯

Answers of Multiple Choice Questions

- 1 (1) (b) part no. (2) only.
 - (2) (d) parts no. (2) and (7).
 - (3) (b) (4).
 - (4) (6).
 - (5) © two parts no. (2) and (9).
- 2 © pharynx.
- © gases exchange.
- © Respiratory enzymes.
- (3) (a) (X).
- (2) (d) (L).
- (b) An amount of sugar is released from it.
- (a) increase of pH value in the blood.
- 8 (b) (2).

- (a) Air that enters into the two lungs contains a greater amount of oxygen than the air that comes out of them.
- 10 @ Remains constant / To inward.
- 11 b.
- 12 c stomata
- 🔢 ⓒ photosynthesis,
- 14 D chloroplast is reversed in the mitochondria.
- E © C₅H₁2O₅

Second Answers of Miscellaneous Questions

- The microbes and foreign materials will enter into the two lungs with the inhaled air and the nose will be dry, as the hairs inside the nose work as sieves and the mucus works as a moisturizer and filter for air.
- They filter the air that enters into the alveoli by moving the foreign particles that may present in it.
- 3 If the trachea is devoid of cartilagmous rings, the walls of trachea would collapse, leading to its closure, suffocation of the living organism and his death, because these rings keep the trachea opened permanently.
- To increase the respiration surface area and the occurrence of gases exchange between the alveolar air and blood in the surrounding blood capillaries.
- 5 The gases exchange process between the alveolar air and blood in the surrounding blood capillaries will not occur.
- 6 Carbon dioxide is formed in the body calls, as a result of the occurrence of cellular respirance process.

Blood capillaries Vens Superior and surrounding inferior vense the body cells cave

artery of the heart of the heart

Blood capillaries surrounding alveoli in the two hungs (CO₂)

_ Right atrium

Pulmonary - Right ventricle -

- Answer by yourself.
- (C): glucose + O₂
 (D): mitochondria. (E): ATP
- In the tube no. (1): no change will occur, because of the non-occurrence of any vital process
 - In the tube no. (2): the percentage of O₂ and CO₂ gases remains relatively constant in water, whereas O₂ gas that results from the photosynthesis process of the aquatic plant is consumed by the aquatic snall in respiration process, producing CO₂ gas that is consumed by the plant in photosynthesis process.
 - In the tube no. (3): the percentage of ${\rm O}_2$ gas increases in the tube, as a result of performing photosynthesis process by the plant
 - In the tube ac. (4): the percentage of CO₂ gus increases in the tube, as a result of performing respiration process by the snard
- The plant will wilt and die, due to the absence of oxygen that is necessary for respiration process, as a result of the non-occurrence of photosynthesis process
- 11 The reason for the death of mouse and burning out of candle in the figure no. (2) is that all the amount of oxygen that presents inside the bell jar is consumed in the mouse respiration and candle burning processes, while in the figure no. (4), the reverse occurs, as the plant performs photosynthesis process, where it consumes CO₂ gas that resulted from the butning of candle to perform photosynthesis process which produces O₂ gas that is used by the mouse to perform respiration process and helps in keeping the candle light.
- P Answer by yourself.
- The plant may perform photosynthesis process by using the carbon dioxide gas that resulted from the respiration process, therefore the limewater that presents in the beaker next to the plant will not be turbid, and therefore the release of carbon dioxide gas during the aerobic respiration in the green plant parts will not be proven.



- (a) Clear timewater.
 - (b) The indicator doesn't change in the tube no. (2), as the green plant in the opposite tube performs respiration and photosynthesis processes, (i.s. CO₂ that resulted from respiration process is consumed by the plant in the photosynthesis process), while in the tube opposite to the tube no. (1), the insect performs respiration process only, (i.e. it consumes O₂ and produces CO₂ that makes the indicator (limewater) turbid)
 - (c) The indicator (limewater) will be tarbid in the two tubes no. (1) and (2).
- 6 * Removing the aquate snails and other living organisms that consume the dissolved oxygen in water that is required for fish respiration.
 - Planting the aquatic green plants as algae to consume carbon dioxide that resulted from the respiration of fish and use it in the photosynthesis process for producing the dissolved oxygen in water that is required for fish respiration.

Answers of Model Exam on chapter

- 2 d Each one of them depends on the other.
- 3 Glucose molecules.
- **4 3** 1:5
- **5** © (3).
- Glycolysis Electron transport chain Krebs cycle.
- (3).
- [3 © lenticels.
- (d) are different in the source of energy.
- 11 (a) CO, and O,
- 11 @ One molecule
- 12 (b) pyruvic acid reduction.
- IB © NAD↑
- 14 (b) Companion cell.

- E (d) 5/9
- (a) similar, because both of them have similar cellular enzymes.
- 🚺 📵 curymes synthesis.
- **8 (b)** 4
- 19 ® oxidation.
- 20 d Loses electrons.
- (a) Carbon dioxide and Oxygen.
- Because blood cells can't use nitrogen gas directly also nitrogen gas isn't concentrated in blood.
- Dust will be filtered by hairs in the nose and tractica, cilia will beat upwards to filter air by moving the small foreign bodies to the pharyux, so that they can be swallowed.
- 23 Both of them produce 2 ATP molecules, occur in lack or absence of oxygen and represent reduction reactions
- The statement is wrong / Because the lung excretes 500 cm³ of water per day in the form of water vapour out of 2500 cm³ lost daily.
- 26 (a) To prevent O₂ passage and allow anaerobic respiration to take place
 - (b) Yellow colour, due to high concentration of CO₂ produced from alcoholic fermentation.
- Sperm cell, needs more glucose molecules to produce more ATP molecules to be used in the sperm movement. So, it has large number of mitochondria.

of Test Yourself Questions



Answers of Chapter One

Lesson

- The statement is wrong / Because the heterotrophs obtain their food from the Sun in an indirect way; they obtain it from the bodies of other living organisms (green plants or from the animals that have previously feed on plants) in the form of high-energy and complex ready organic food substances, while the autotrophs obtain their food from the Sun directly through the photosynthesis process.
- (2) (b) (2).
- The concentration of solution inside the sap vacuole of the root hair will be less than that of soil solution. So, the root hair loses its water content.
- Due to their large size they can't pass
 through the tiny pores of plasma membrane.
 - 2 (1) (b) (Y) to (X) by osmosis.
 - (2) (
 - (3) (a) high in both of them.
 - 3 (1) Because the particles of insecticides transfer by diffusion from the high concentrated medium inside the fruits cells to the low cor centrated medium of the sugary solution. So, we can get rid of them without affecting the fruits taste.
 - (2) Because the tissue papers are made of cellulose which has the ability to absorb water (sweat) by imbibition.
- (5) (d) The leaves turn yellow.
- 6 1 Plant absorbs :
 - Magnesium ions from the soil by active transport phenomenon.
 - Nitrate ions from the soil by diffusion phenomenon.

2 (6



1 (1) To collect the greatest amount of light, which increases its efficiency during the photosynthesis process.

- (2) Whereas the green pepper's cells contain high amount of chlorophyll pigments, yellow pepper's cells contain high amount of xunthophyll pigments, while orange pepper's cells contain high amount of carotene pigments.
- 2 (1) @ X

(2) (a) Mg

(3) © Z

(4) (A) X

- 2 1 © palisade layer
 - 2 As cutin is impermeable for water and mineral salts, therefore the aquatic plants don't need it on their cells' walls to be allowed to absorb water and mineral salts, while in desert plants cutin thickness increases to keep more water inside the plant and reduces the water loss during transpiration.
- 3 1 (1) (A) : sulphur bacteria.
 - (B) green plant
 - (2) (X) . sulphur
 - (Y) : glucose.
 - (Z): water 2 (1) (d)
- (L) : oxygen.
- (1) (0)
- (2) (b) Glucose and water.
- (1) The ability of the plant to perform photosynthesis process decreases, because water is the source of hydrogen required for CO₂ fixation in dark reactions, which is needed for carbohydrates formation.
 - (2) Hydrogen produced from water splitting will escape or recombine with oxygen again So. NADPH₂ which is required for the dark reaction won t be formed, therefore photosynthesis process stops
- (i.e. in a direct way), while the corn starch and corn oil were produced in an indirect way, whereas the glucose produced from the photosynthesis process is converted into starch or fats (corn oil).
 - 2 Because the glucose molecule is a hexose sugar produced from the combination of two molecules of phosphoglyceraldehyde which has 3 carbon atoms
- (a) · Factor (A) Light
 - · Factor (B) Temperature

- (b) Curve (A) affects the rate of light reactions, whereas they take place in grana inside the chloroplast, where the chlorophyll pigments are present which absorb light. So, light is the limiting factor.
 - Curve (B) affects the rate of dark reactions, whereas they take place in stroma, temperature is the limiting factor of the dark reactions as they are enzymatic reactions

Leavin K

- Because the breaking down of large and complex-structured food substances into simple-structured and small-sized molecules which are easily absorbed by the cells, by means of hydrolysis and this process is catalyzed by enzymes that their activity depends on the body temperature constancy at 37°C which is the optimum temperature for the digestive enzymes to work with maximum efficiency.
- 2 1 (1) (b) The concentration of disaccharides at point (b) is more than that at point (a).
 - (2) © voluntary, then involuntary process.
 - 2 Since amylase enzyme work on the hydrolysis of starch that found in each of rice, potato and bread So, amylase hydrolyzes starch into disaccharide maltose. Which doesn't antagonize with its specificity
 - 3 To manipulate food and mix it with saliva which contains:
 - Mucus that softens the food and facilitates its swallowing.
 - Amylase enzyme "Ptyalin" which catalyzes the hydrolysis of starch into disaccharide maltose
 - 4 The statement is wrong / Because the action of amylase "Payalin" enzyme continues during the passage of food through the oesophagus. So, its digestion doesn't stop
- The statement is wrong / Because ptyalin action continues during the food passage in oesophagus So, the starch digestion doesn't ston

- 2 The stomach content (gastric jurces including HCI) will flow back into occophagus causing "Gastro-occophageal reflux"
- (1) (1) (2) The digestion of fats (2) (3) (3) (4) (4) (3) amylase.
 - 2 Trypsinogen is secreted in an inactive form to protect the pancreatic tissues from digestion, as they are made of protein, then it becomes active trypsin by the action of enterokinase in duodenum to hydrolyze protein in the small intestine into polypeptides, while amylase enzyme is secreated in an active form, since it hydrolyze strach and glycogen into maliose, therefore it doesn't affect pancreatic tissues.
- (1) (a) thus and rich in blood capillaries.
 (2) (a) Fatty acids.
- 6 Mucus is secreated along the alimentary canal in :
 - Mouth: secreated from salivary glands, where it softens food and facilitates its swallowing.
 - Oesophagus: secreated from the lining glands, where it facilitates food sweep and its transport to the stomach by the help of prestalisis.
 - Stomach: secreated from the inner walls of stomach, where it protects the inner wills from being digested by gastric jucies.
 - Large intestine it is secreated to facilitate the passage of food wastes to outside.



Answers of Chapter Two

- Lesson 🧵
- 1 Since the green plant produces phosphoglyceraldehyde compound (PGAL) during photosynthesis process which is used in the formation of proteins and fats.
 - 2 6 Leaves and phloem tissues.
- (2) 1 (1) (b) transport.
 - (2) a Parenchyma cells.
 - 2 Because each sieve tube has a nucleated campanion cell containing a large number of ribosomes and mitochondria which enable it to organize the vital processes of sieve tubes like transporting food substances.
 - 3 The starch granules are stored in several regions in the plant which are:
 - Mesophyll tissue in the green leaves whose cells (palisade and spongy layers) contain chloroplasts having starch granules.
 - Starch sheath in the inner most row of cells of the cortex in the stem of a dicot plant.
 - Pith parenchyma cells in the centre of vascular cylinder in the stem of dicot plant.
- (1) (1) (d) vanished.
 - (2) (c) Pinus.
 - (3) © Its presence is It rated in the walls of xylem vessels
 - 2 Because transpiration rate increases in daytime with the increasing in temperature specially at the noon, therefore the leaves lose water vapour that presents in the air chambers in the transpiration process through the stomata. So, water in the xylem vessels will be subjected to a great pulling force, therefore water will ascend through the xylem vessels and tracheds of both stem and root, as they are connected to each other. So, water transfers faster at right.
 - 3 The stomata in the leaves of Iris plant are present in the upper surface that are opened usually to get rid of excess water, whereas the transpiration rate is almost equals the absorption rate, the stomata will disappear from the lower surface as they become usualess.

- 1 Transport process in phloem stops, because it is an active process needs energy-carrier molecules (ATP) that are present abundantly in the companion cells that contain large number of mitochondria which enable them to organize the transport processes through sieve tubes.
 - 2 Because the transport process in phloem affected by temperature, therefore when the temperature decreases in cold regions the movement of cytoplasm and its streaming become slow So, the active transport process becomes slower in cold regions than in equatorial regions.

Lesson 2

- Transport process in small animals (as protozoa and Hydra) doesn't need a specialized transport system, whereas respiratory gases and food substances are transported by diffusion. While in bigger and more complicated animals diffusion isn't sufficient for transportation of food and oxygen to the various tissues, therefore the presence of a specialized transport system is essential in these animals.
- 2 1 a AB
 - 2 The statement is correct / Since ventricles are thick-walled muscular chambers because they pump blood through a long distance to all the body (left ventricle thicker than right one), while atria are thin-walled muscular chambers, since they pump blood to the ventricles which is a short distance. Left ventricle is thicker than the right one, because it pumps blood through sorta to all the body parts, while the right ventricle pumps blood through pulmonary artery to the lungs.
- (3) 1 (3) Aorta.
 - 2 Arteries are thick muscular vessels, have high blood pressure as they pass blood from heart to all body pasts, they also have the ability to pulsate
 - Veins are thinner than the arteries and have less musular walls, have low blood pressure as they pass blood from body parts to the heart, they also don't have the ability to pulsate.
 - Blood capillaries are very thin, they have tiny pores for quick exchange of substances between cells of ussues and blood

- (4) 1 (1) (b) 46%
 - (2) (1) the resistance of diseases.
 2 Because they contain large amount of hemoglobin which works on transfering O₂ from the two lungs to the different body cells (oxyhaemoglobin) and transfering CO₂ from the different body cells to the two lungs (carbo-aminohaemoglobin).
- (1) (absence of one of the blood clotting factors from blood
 - (2) (d) Heparin.
- (6) @ contracting the left atrium.

Lesson 🔞

- the opening of mitral valve.
- 2 1 © pulmonary vein. 2 (3) _____(1) ____(4) ____
- (3) (1) (a) Small intestine _____ Hepatic portal vein _____ Hepatic vein _____ Inferior vena cava.
 - (2) (b) liver
- (1) © prothrombin.
- (2) (2) Right atrium.

Answers of Chapter Three

Lesson

- Because when the ATP molecule converts to
 ADP an amount of energy is released which is
 about 7-12 kcal/mole
- **② ©** 360
- 3 1 (1) (2 molecules of ATP
 - (2) a glucose 6-phosphate.
 - 2 As the conversion of ATP into ADP is accompanied by releasing of phosphair group that enters in the formation of some compounds during glycolysis such as glucose 6-phosphate and fructose 1, 6 diphosphate.
- 1 CO₂ produced from Krebs cycle enters the blood circulation, combining with the RBCs' Hb and released out as a final product of respiration and can be used by plants in phonosynthesis process.

- 2 As each molecule of pyruvic acid is oxidized to change into acetyl group which combines with coenzyme (A) forming acetyl coenzyme (A), whereas acetyl CoA yoins the Krebs cycle and CoA splits off the acetyl group to repeat its role in another cycle.
- 3 @ citric
- (1) © complete occurrence of exidative phosphorylation process
 - (2) 6 4 ATP molecules.
- Because it produces 2 molecules of NAD*
 used by the cell in continuing and repeating
 the glycolysis process and obtaining more
 ATP molecules.
 - 2 6 oxygen

Lesson

- (a) * (A) Inside
 - (B) outside
 - (b) Gascous exchange process
 between the alveolar (B)
 air and the surrounding
 blood in the blood
 capillanes, whereas CO₂ comes out from
 the blood to the alveolar air at (C) and O₂
 enters from the alveolar air to the blood at

(c)

Blood cell (E)	Blood cell (F)
Carries carbo-amino haemoglobin.	Carries oxyhaemogloban.
Dark-red coloured.	Light-red coloured.

- (a) CO₂ concentration decreased from (A) to
 (B) during the day time (from the morning tall the afternoon), because it is used in photosynthesis process. So, the rate of CO₂ gas consumbtion mercases, therefore its concentration decreases.
 - (b) The curve elevates from (B) to (C) as the light intensity decreases gradually. So, the rate of photosynthesis process decreases and the rate of respiration process increases, therefore CO₂ gas evolves and its concentration increases gradually.

ANSWERS

of the Model Exams



- a Stomach and duodenum.
- 🔼 d Green algae and human.
- 1 C Heparin.
- 1 (Y).
- (ambium.
- (6) (b) Increasing the surface area of the alveoli.
- Tricuspid valve and pulmonary valve.
- (1) Artery.
- b it occurs inside the mitochondria.
- diffusion
- **1** 3
- 2 @ RBCs
- (b) oxidation
- Pancreas
- Sucrose moves by active transport from the mesophyll to the leaves then to the phloem.
- (8) presence of DNA molecules.
- 12 (d) The breaking down of chemical bonds between factose molecules produces high rate of monosacchandes.
- (4) (B) (B)
- 🔟 🕒 water and salts transfer by capillarity phenomenon
- (a) Movement of chlorophyll molecule electrons.
- Because the root hairs secrete viscous substance which help them to find their way easily among the soil particles also help to stick to the soil particles, and so they can fix the plant into the soil.
- 2NADH~3FADH, =6ATP
- Liver.
- The statement is wrong / Because some glycerol and fatty acids may recombine again forming fats inside the villi, these fats pass into the lacteal vessels inside the villi, then to the lymphatic

- system which carries them slowly and empties them into the superior vena cava, then to the heart.
- (1) The nature of dark reactions in photosynthesis.
 - (2) The role of sieve tubes in transporting the ready made food substances to all the plant parts.
- (a) Stages (1) and (3) represent the darkness.
 (b) Curve (B) represent (¹⁶O).



- CO2 that is required to perform photosynthesis
- 🔁 🕲 a decrease in the number of red blood corpuscles.
- amber of coenzymes (A).
- (d) Amino acids and carbohydrates don't transfer to the roots
- 5 b Dark reactions only.
- The innermost row of cortex.
- (b) Vein.
- 1:5
- D He can eat fats in small amounts.
- 🔟 📵 imbibition.
- 1 d
- D © cell (2) & cell (4) / cell (1) & cell (3)
- 13 C 7
- **基**(B).
- (d) Meat.
- 10 hepatic portal vein.
- 😰 © dark reactions in both of them.
- (C) Meat & junces.
- **6**
- (b) The concentration of cell sap of root cells.
- Opening of semi-lunar valves.
- Water is considered the source of hydrogen which is required for CO, fixation during the dark reactions of photosynthesis process.



- Due to their large size.
- 2 NADH molecules.
 - 2 CO, molecules.
 - · 2 Acetyl coenzyme (A) molecules.
- 25

Blood capillaries in villi Blood capillaries in alveoli

- A network of venous and arterial blood capillaries surrounding the lacted vessel
- They are responsible for absorption of the digested food through the blood route.
- They transport H₂O, mineral salts monosaccharides, amino acids and water soluble vitamins through the blood capillaries to the hepatic portol vein then to the liver and from it to the hepatic vein to be compiled into the inferior vena cave, then to the hepatic.
- A network of venous and arterial blood capillaries surrounding the alveols
- They a responsible for gas exchange between the niveolar air and the surrounding blood in the blood capillaries.
- They receive O₂ from the alveolar air and the broochioles of the lungs froming oxylaemoglobin "arteries blood" transporting O₂ to all body parts.
- They receive CO₂ from the body cells forming carbo-aminobuemoglobin "veins blood" transporting CO₂ to the lungs to excrete it out of the body.
- 🌃 (a) To inside the tube.
 - (b) To absorb CO₂ evolved from the plant respiration, therefore the volume of air inside the tube decreases, and so we can determine the rate of respiration by measuring the distance moved by the ink drop.
- The statement is correct / Because the stomach secretes the gastric puce which contains HCl that creates an acidic medium which helps in killing the harmful bacteria that may enter with food

- (B) (B).
- Contains a higher percentage of CO, than O,
- (b) 24
- (2)
- Bicuspid valve and aortic valve

- (d) Left ventricle contraction.
- Cellulose.
- **3** (d)
- d converting organic compounds into inorganic compounds.
- 🔟 🕲 Pinus
- 10 d loses electrons.
- 22 (A) (X) . (Z).
- 13 d Each of them produces CO2
- **B**(0)
- LS (a) Water and salts absorption stops completely.
- 16 (a) an increase in the transport rate.
- 17 (d) (2) only.
- 1 d) C --- A and B --- A
- 15 6 Spongy.
- 20 © 4
- 2 3/1/1/1X
- Because vitamin K which plays an important role in clot formation, dissolves in fats that are transported to the blood through the lymph
- The absence of sup vacuole (Y) from the root hair (X) affects the absorption of H₂O and salts by the plant root as the vacuole is responsible for the regulation of water concentration inside the cell, therefore its absence causes a disturbance in the osmotic pressure inside the plant root cells. So, the root cells may rupture and the root become non-functioning, and so the plant will wilt and die.
- The conversion of ATP into ADP produces phosphate group which enters in the formation of some compounds produced during glycolysis such as, glucose 6-phosphate and fructose 1,6-diphosphate.
- Lactic acid / Because the blood clot which blocks the artery causes a deficiency in the muscle O₂ supply, therefore the muscle tissue performs anaerobic cellular respiration "acidic fermentation" leading to the accumulation of lactic acid in the muscule tissue

- 26 Dark reactions of photosynthesis process: used in building glucose, starch, proteins and lipids.
 - Glycolysis process used as a high-energy compound in cellular respiration.
- Structure no. (1) / Because the glucose molecules diffuse from the villi that found in the small intestine to the solution in the container, while the glucose molecules can't pass through structure no (2) "semi - permeable membrane", therefore it prevents the passage of sugar molecules.

- 🚺 🕝 superior vena cava.
- the iron and hacmoglobin percentage decreases in the blood
- (C) the absorption of macro-nutrients only.
- 5 b opening of pulmonary valve.
- **6** (3).
- 7 © wall of alveolus is thin and has a large surface
- 8 © When the two strin contract, the semi-lunar
- a) the increase of released energy amount from one molecule of glucose
- (d) oxygen.
- (i) C The enzymes present in them become inactive by heating and cooking.
- 12 (d) (D).
- 2 a Epithelial layer.
- 📴 🕲 bacteria.
- B @ 8
- [d Spleen
- **7** (3)
- 🔞 © O₂ releasing
- 15 (b) O2, CO2
- (D) Exidation of NADH
- 23 C
- Both of them can take place in absence of oxygen accompanied with coenzymes reduction and produce ATP molecules.

23 The stomata of herbaceous plant stem help in exchange of respiratory gases between the stem cells and air, where O2 diffuses into the stem and goes to all the cells of the plant. While the woody stem contains lenticels instead of stomata and they allow the exchange of respiratory gases between air and the cells of woody stem

Epidermis in root	Epidermis in stem
Root hair extended from a single cell of epidermis.	One raw of adjacent barrel-shaped parenchyma cells covered by cutin.
 Contains high concentrated cell sap to absorb water from the soil by osmosis. 	 Contains stomats the main site of gas exchange, O₂ entry and transpiration
 Root hair are large in number and protruding outside to increase the surface area of water and salts absorption 	Barrel-shaped colouriess cells have no chlorophyll to converge light rays for the collenchyma cells to perform photosynthesis
Root hair secrete viscous substances to allow the root hairs to find their way easily among soil partoeles, stick to them and fix the plant in soil.	 It is covered by cutin layer to reduce the water loss by transpiration,

- The statement is wrong / Because there is a group of respiratory enzymes which helps in the aerobic and anaerobic cellular respiration processes.
- 27 The cell is in active state, because it consumes ATP molecules converting them into ADP molecules to use the ATP released energy.



- Calcium
- 🛂 🕢 an ummunization function.
- 3 d cambium
- (a) each one of them is catabolism
- 5 © a source for hydrogen that is required for the reduction process.
- b Intercellular spaces ← Cell wall Plasma membrane ---- Cytoplasm -Plastid's membrane.

- (B) to (A)
- (a) the two statements are correct.
- O opening of semi-lunar valves.
- (1).
- mall intestine peptidase.
- (C) Starch.
- (b) and (c) together.
- (b) Glucose / 3
- 15 (b) (1) , (4).
- 16 (a) Energy production.
- Stopping the light and dark reactions.
- 18 d Artery / Vein / Blood capillaries.
- 10 C
- (a) decreasing of salts in the soil.
- 🐼 To keep the greatest amount of water inside the plant cells by increasing the concentration of solutes in the solution. So, it can adapt to the surrounding environment.
- Arrow no. (4) / Aorta artery.

Anaerobic respiration in animal cells "Acidic fermentation"

- Anaerobic respiration in plant cells 'Alcoholic fermentation"
- It is resulted from reduction of pyruvic acid
- into lactic acid. It occurs in the animal cells especially muscular cells, when the muscles
- exert vigorous effort. It causes muscular
- It is resulted from the reduction of pyruvic acid into ethyl alcohol and CO,
- It occurs in some plant
- fatigue.
- It is used in the industry of some products, such as alcohol and bread industries.
- 25 The statement is wrong / Because the vascular bundle of the stem contains cambium (not found in the leaf) in addition to xylem and phloem, which are found in both stem and leaf.
- 26 (a) 38 molecules of ATP (b) (3), (2), (1).

- [5] (1) "Lacteal vessels" ——- Lymphatic system
 - Hepatic vein ------ Inferior vena cava --Heart.



- (4).
- 2 d storage of the raw materials that are required to perform the photosynthesis process.
- (a) increase of lactic acid in the blood.
- (d) closure of semi-lunar valves.
- c the highest flow of water in the stem is delayed for the highest transpiration rate.
- (1).
- 1 (b) They work at the same pH value.
- The number of resulted ATP molecules will
- (2) & (3).
- (C) the carbohydrates digestion continues.
- (C) specific enzymes.
- to the pressure of water column in xylem vessels.
- (a) Difficulty in the light passage.
- 13 d Youth Elderhood Childhood.
- (c) cells' membranes.
- 16 © Photosynthetic phosphorylation.
- B BW/X/Z/Y/Y-Z
- (B) Hepatic portal vein.
- 6 the concentration of salts in the solution is more than their concentration in the blood cells.
- @ (L).
- (a) In both of them a 3-carbon compound is formed.
- Because amylase "ptyalin" enzyme works on the hydrolysis of starch into disaccharide (maltose). therefore it doesn't affect the mouth lining. While pepsin enzyme is secreted in an inactive form of pepsinogen from the stomach cells as it works on the hydrolysis of protein into chains of polypeptides, therefore if it is secreted in the active form it will digest the cells lining the stomach which are made of protein.

- The plant won't absorb water and mineral salts. therefore a great amount of nutrients won't be available. So, the plant will die.
- 25 The statement is correct / Because the phloem translocates the manfactured food from the leaf to all the plant parts on the basis of "cytoplasmic streaming theory" which is affected by temperature and O_2 , so that if the temperature decreases or in case of O, deficiency the cytoplasm movement and its streaming in the sieve tubes are delayed leading to the delay of active transport process in the phloem.
- The re-production of 2 molecules of NAD* to allow glycolysis process to continue and produces more ATP molecules.
- (X): Pulmonary artery.
 - * (Y) : vena cava.

- (2).
- 3 Glycolysis.
- (1) (d) the concentration of maltose in the fourth minute is higher than the concentration of
- The percentage of N₂ in the inhaled air with its percentage in the exhaled air.
- 6 © the first statement is correct and the second statement is wrong.
- **(b)** 10
- (b) Fatty acids.
- [9] (a) Plasma and white blood corpuscles.
- (c) the type of chlorophyll and the source of hydrogen required to reduce CO, in each one
- M.O splitting in photosynthesis process.
- [22] (d) Exit of water from the lips' cells that leads to their shrinkage.
- 13 @ 8

- (a) Superior vena cava.
- (actic acid, Glucose,
- 6 left ventricle.
- (a) Low / Low
- (d) Sap transfer.
- Yeast fungus.
- C Elodea.
- (a) ATP
- The solution in tube (X) remains clear, because boiling kills the protoplasm. So, the dead seeds
- Because of the high rate of transpiration at noon and its lower rate at night.
- The plant will wilt and die.
- (a) Because the point (A) "atrio-venticular node" is stimulated when the electrical nerve impulse reaches it from the sino-atrial node.
 - (b) The contraction of (B) "ventricles" is important in pushing all the oxygenated blood of the left ventricle through the aorta and all the de-oxygenated blood of the right ventricle through the pulmonary artery.
- The statement is correct / Because when the O, is available the cell performs aerobic respiration to produce the energy "38 ATP" required for the vital processes of the cell.
- (a) (2) Pancreas.
 - (b) (I) Stomach.

- 2 d 3-carbon compound is formed in each one of
- C Pulmonary vein.
- 8 🕟 🖪
- **5 6**
- MADPH, and ATP
- (arbo-aminohaemoglobin.
- (b) One Krebs cycle.

- (C) an alveohis.
- (C) pancreas.
- 11 a water.
- B @ 1:3
- @ (F) 1:2
- (I) (I) Amino acids.
- 1 (b) Increases / Decreases
- (a) opening of the valve when the muscles contract.
- (c) Diffusion.
- Ma AB
- (1) Lipase enzyme.
- 150 (b) 150
- (d) Glycine and CIT
- active transport and permeability
- Xylem vessels and tracheids.
- 23 FADH
- Because the glucose molecule needs ATP to be converted into glucose 6-phosphate and starts glycolysis, also fructose 6-phosphate needs ATP to be converted into fructose 1,6-diphosphate.
- The RBCs will shrink when the saline concentration is 1%, while they brust when the saline concentration is 0.7% and this happens, due to the transfer of water molecules by osmosis from the highly concentrated medium to the lower concentrated medium according to the water molecules.
- 26 The statement is correct / Because the blood flow in arteries occurs under high pressure, due to the thick pulsating muscular walls of the arteries middle layer that contract and relax under the control of nerve fibers and they have endothelium topped with elastic fibers which acquire the arteries with the required elasticity to pump the blood during ventricles contraction. But the veins carry the blood under low pressure as they have thin muscular walls of their middle layer that can't pulsate and also their endothelium has rare elastic fibers and some of them have valves to prevent the back flow of the blood, allowing its passage in one direction (to the heart), as the veins of the limbs that are present near the skin surface.

- *(1) Pepsin enzyme.
 - (2) Trypsin enzyme.

- (b) pulmonary valve and sortic valve,
- Carrie seid from pyruvic seid.
- 3 (3) 45
- Wascular bundle-Pericycle-Cortex-Epidermis.
- 5 C the limewater is clear.
- 6 b two.
- Peptidase.
- 8 (1) and (4).
- d fibrinogen.
- 10 © respiratory enzymes.
- 11 (b) Penaut butter.
- Sugar and amino acids transfer together by active transport in the same sieve tube of phloem.
- 13 (1) 160
- 14 (d) Yeast fungus.
- 5 (a)
- (b) Adhesion force between H₂O molecules and walls of xylem vessels.
- oxyhaemoglobin
- 18 (a) Active transport and diffusion.
- © 150
- 20 (b) shrink, due to H,O exit from its sap vacuole.
- (a) two Krebs cycles occur.
- Because the leaves are the sites of the high-energy organic food substances (carbohydrates, fats and proteins) production that will be transported through the sieve tubes of the phloem to the different plant parts for storage and consumption.
- When the RBCs become old they are broken down and the body restores their proteins to use them in the formation of bile juice that convert fats into emulsified fats to facilitate their direction.
- 23 Absence of coenzymes or cytochromes.

- [(a) HCl acid of the gastric juice. (b) Sodium bicarbonate of the pancreatic juice.
- 26 The lung gets O, from the inhaled air then the blood capillaries surrounding the alveolar air receives O, and transfers it to the body parts through the oxygenated blood and another amount of O2 lost from the two lungs as water vapour in the exhaled air, while the CO, enters the lungs from the deoxygenated blood then gases exchange takes place between the alvolar air and the surrounding blood in the blood capillaries to supply body with O, and get rid of CO, through the exhaled air.
- * (X) : doesn't change.
 - (Y) : changes into dark blue colour.

- 🚺 📵 gastric juices.
- 2 d one Krebs cycle.
- 3 the water pressure decreases inside the leaf cells with increasing the transpiration process.
- blood vessel buried among the muscles.
- **5 6** 4
- 6 d ADP from ATP in the stroma.
- 7 a Bile juice.
- (8) (a) from the alcoholic fermentation is greater than that from the acidic fermentation.
- (a) Most of the released water from the leaf gets out through the stomata.
- d require coenzyme.
- (B) Renal artery.
- 12 (a) Cambium.
- 13 d Diffusion to the venules (venous capillaries).
- Plenty of O, inside root cells.
- E C circulatory system is closed, while lymphatic is opened.
- (a) Amylase only.
- (C) equals to
- 1 C
- (a) NADH gives its electrons to the cytochrome at higher energy levels.

- 20 d Plasma membranes and cellulose walls.
- 21 © 0.45%
- Because the heartheats rate changes according to the physical and psychological states of the body, since the sino-atrial node is connected to the (sympathetic nerve) which increases the rate of heartheats during performing vigorous physical exercise to supply the muscles with enough O2 to perform aerobic respiration to do its physical exercise.
- The plant will wilt and die, due to the deficiency in the absorbed water and salts through the xylem vessels as a result of decreased adhesion force between the xylem vessels and H₂O molecules.
- 33 If the element (X) "14CO2" is supplied intermittently, the dark reactions would take long time or wouldn't happen, because CO, is needed for the formation of glucose which is formed through several intermediate reactions, whereas the phosphoglyceraldehyde (PGAL) which is formed quickly "after 2 seconds" in the main experiment is used in building glucose. So, the nature of the dark reaction can't be detected or revealed.
- The statement is correct / Because the root gets O, dissolved in water which is absorbed from the soil by the root hairs during the absorption of mineral salts which needs O2 to be absorbed by active transport. So, the respiration rate increases.
- 26 Because the medicine may be affected by the stomach acidity or it's difficult to be absorbed through the intestine.
 - . To reach the blood faster as it enters the systemic circulation directly.
- (A) Water level rises up, due to the evolved CO, from seeds respiration absorbing O, gas and soda lime absorbs CO,
 - (B) Water level remains constant, because the dead seeds don't respire.